TECHNO INDIA – BATANAGAR

(DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING)
QUESTION BANK- 2018

QUESTION PAPER DETAILS					
Course	Stream	Semester	Subject	Paper Code	Chapter
B. Tech	ECE	6th	Digital Communication	EC-601	1.Probability Theory & Random Process

Paper Setter Detail			
Name	Designation	Mobile No.	E-mail ID
Swati Chowdhuri	Assistant Professor	9434572494	Swati.chowdhuri@tib.edu.in

MCQ: <u>Type-1</u> (Maximum marks to be allotted =1)

    i. The CDF is always lies between
        a) 0 and 1   b) 0 and 2   c) 0 and 3   d) none of the above

    ii. The property states that $F_X (\infty)=$
        a) 1   b) 2   c) 3   d) 4

    iii. Which is true for CDF
        a) Monotone increasing function   b) monotone decreasing function
        c) always constant   d)none of the above

    iv. Power spectral density of white noise is
        a) $N_0/2$ b)$N_0/3$ c)$N_0/4$ d)$N_0/5$

    v. Random variables give relationship between _____
        a) Two random events   b) Probability of occurrence of two random events
        c) Random event and a real number   d) Random event and its probability of occurrence

    vi.The distribution function of random variable is
        a) P(X less than or equal to x)   b) P(X greater than or equal to x)
        c) P(X less than x)   d) P(X greater than x)

    vii.The value of probability density function of random variable is
        a) Positive function   b) Negative function   c) Zero   d) One

Short Question (Type-2): (Maximum marks to be allotted =2)

1. What is error function?
2. What is conditional probability?
3. State Central limit theorem.
4. Define Probability Density Function (PDF) and explain its significance.
5. Discuss the property of auto-correlation function

Subjective Question (Type-3): (Maximum marks to be allotted =3)

1. State the reason of importance of Gaussian random variable.
2. Differentiate between random variable and random process with suitable example.
3. Discuss the property of auto-correlation functions.
4. Prove that

$$P(x_1 < X \le x_2) = \int_{x_1}^{x_2} f_x(x)dx$$

Broad Question (Type-4): (Maximum marks to be allotted =5)

1. Difference between random variables and random process with suitable example
2. The PDF of a random variable 'X' is given as
$f_x(x)=Ke^{-ax}$ for x≥0

   =0   for x<0 and K, a >0

   i)   Find the value of K in terms of a.

   ii)   Find m_x and $\sigma^2 x$

QUESTION PAPER DETAILS					
Course	Stream	Semester	Subject	Paper Code	Chapter
B. Tech	ECE	6th	Digital Communication	EC-601	2. Signal Vector Representation

Paper Setter Detail			
Name	Designation	Mobile No.	E-mail ID
Swati Chowdhuri	Assistant Professor	9434572494	Swati.chowdhuri@tib.edu.in

MCQ: Type-1 (Maximum marks to be allotted =1)

i. Which gives the measure of randomness of the random variable?
   a) Mean   b) Variance   c) Standard variance   d) PDF

ii. A random process is called as stationary in strict sense if
   a) Its statistics vary with shift in time origin
   b) Its statistics does not vary with shift in time origin
   c) Its autocorrelation vary with shift in time
   d) Its autocorrelation does not vary with shift in time

iii. For stationary process, autocorrelation function depends on
   a) Time   b) Time difference
   c) Does not depend on time   d) None of the mentioned

iv. The average power of white noise is
   a) Zero   b) Unity
   c) Infinity   d) Between zero and one

v. According to the rule of minimizing the error probabilities the hypothesis should be like if the priori probabilities is _____ than the ratio of likelihoods.
   a) Lesser
   b) Greater
   c) Equal
   d) None of the mentioned

vi. The detector that minimizes the error probability is called as
   a) Maximum likelihood detector
   b) Minimum likelihood detector
   c) Maximum & Minimum likelihood detector
   d) None of the mentioned

vii. The likelihood ratio test is done between
   a) Likelihood of s1 by likelihood of s2

b) Likelihood of s2 by likelihood of s1
c) Both of the mentioned
d) None of the mentioned

Short Question (Type-2): (Maximum marks to be allotted =2)
1. How is orthogonality of two signals defined?
2. What do mean by orthonomality of two signals?
3. What is wide sensed stationary process?
4. State Maximum Likelihood Decision rule.

Subjective Question (Type-3): (Maximum marks to be allotted =3)
1. What do you mean by Schwartz inequality
2. What is Type I and Type II error?
3. State and explain the properties of PSD.
4. Derive the expression for error function of AWGN channel.

Broad Question (Type-4): (Maximum marks to be allotted =5)

1. Explain the term 'norm of the signal'? What is physical significance?
2. Prove Gram-Schmidt orthogonilization procedure.
3. Determine the autocorrelation function of the stochastic process $x(t) = A\sin(2\pi f\, t + \theta)$; where fc is a constant and θ is a uniformly distributed phase

QUESTION PAPER DETAILS					
Course	Stream	Semester	Subject	Paper Code	Chapter
B. Tech	ECE	6th	Digital Communication	EC-601	3. Digital Data Transmission

Paper Setter Detail			
Name	Designation	Mobile No.	E-mail ID
Swati Chowdhuri	Assistant Professor	9434572494	Swati.chowdhuri@tib.edu.in

MCQ: Type-1 (Maximum marks to be allotted =1)
i) In uniform quantization process
    a. The step size remains same   b. Step size varies according to the values of the input signal
    c. The quantizer has linear characteristics   d. Both a and c are correct
ii) The process of converting the analog sample into discrete form is called
    a. Modulation   b. Multiplexing   c. Quantization   d. Sampling
iii) The characteristics of compressor in μ-law companding are
    a. Continuous in nature   b. Logarithmic in nature
    c. Linear in nature   d. Discrete in nature
iv) The modulation techniques used to convert analog signal into digital signal are
    a. Pulse code modulation   b. Delta modulation
    c. Adaptive delta modulation   d. All of the above

v) The sequence of operations in which PCM is done is
      a. Sampling, quantizing, encoding   b. Quantizing, encoding, sampling
      c. Quantizing, sampling, encoding   d. None of the above

vi) In PCM, the parameter varied in accordance with the amplitude of the modulating signal is
      a. Amplitude   b. Frequency   c. Phase   d. None of the above

vii) One of the disadvantages of PCM is
      a. It requires large bandwidth   b. Very high noise
      c. cannot be decoded easily   d. All of the above

viii) The expression for bandwidth BW of a PCM system, where v is the number of bits per sample and f_m is the modulating frequency, is given by
      a. $BW \geq vf_m$ b. $BW \leq vf_m$ c. $BW \geq 2\, vf_m$ d. $BW \geq 1/2\, vf_m$

ix) In Delta modulation,
      a. One bit per sample is transmitted   b. All coded bits used for sampling are transmitted
      c. The step size is fixed   d. Both a and c are correct

x) In digital transmission, the modulation technique that requires minimum bandwidth is
      a. Delta modulation   b. PCM   c. DPCM   d. PAM

xi) In Delta Modulation, the bit rate is
      a. N times the sampling frequency   b. N times the modulating frequency
      c. N times the nyquist criteria   d. None of the above

xii) In Differential Pulse Code Modulation techniques, the decoding is performed by
      a. Accumulator   b. Sampler   c. PLL   d. Quantizer

xiii) DPCM is a technique
      a. To convert analog signal into digital signal
      b. Where difference between successive samples of the analog signals are encoded into n-bit data streams
      c. Where digital codes are the quantized values of the predicted value
      d. All of the above

xiv) DPCM suffers from
      a. Slope over load distortion   b. Quantization noise
      c. Both a & b   d. None of the above

xv) The noise that affects PCM
      a. Transmission noise   b. Quantizing noise   c. Transit noise   d. Both a and b are correct

xvi) The factors that cause quantizing error in delta modulation are
      a. Slope overload distortion   b. Granular noise
      c. White noise   d. Both a and b are correct

xvii) Granular noise occurs when
      a. Step size is too small   b. Step size is too large
      c. There is interference from the adjacent channel   d. Bandwidth is too large

xviii) The digital modulation technique in which the step size is varied according to the variation in the slope of the input is called
      a. Delta modulation   b. PCM   c. Adaptive delta modulation   d. PAM

xix) The digital modulation scheme in which the step size is not fixed is
      a. Delta modulation   b. Adaptive delta modulation   c. DPCM   d. PCM

xx) In Adaptive Delta Modulation, the slope error reduces and
      a. Quantization error decreases   b. Quantization error increases
      c. Quantization error remains same   d. None of the above

xxi) The Nyquist rate for a signal x(t)=5 cos(2π x 500t) is….
      a) 1200Hz   b) 1000Hz   c) 2000Hz   d) 1500Hz

Short Question (Type-2): (Maximum marks to be allotted =2)
1. What are the properties of line coding
2. What is raised cosine spectrum?

3. What is the role of an equalizer?
4. What is Nyquist criterion for Inter-symbol interference?
5. What do you mean by optimum filter?
6. What is matched filter?

Subjective Question (Type-3): (Maximum marks to be allotted =3)
1. State and explain the Nyquist criterion for zero ISI.
2. Why non uniform unitization is needed?
3. Briefly discuss the μ law and A law companding.
4. Calculate the value of Quantization noise?
5. What is companding? Why companding is needed?
6. Explain Companding with suitable diagram.
7. Mention the need of optimum transmitting and receiving filter in baseband data transmission.
8. What are the limitations of ideal solution and how ISI can be solved with the help of Raised Cosine Function?
9. Explain how the bit synchronizer is useful to avoid ISI.
10. Estimate the signal to quantization noise ratio for PCM system.
11. How DM is improve over PCM. Calculate the SNR of DM system?
12. How slope overload distortion minimize by adaptive delta modulation?

Broad Question (Type-4): (Maximum marks to be allotted =5)

1. State and prove Sampling theorem
2. Write block diagram of generation and detection method of Delta Modulation.
3. What are the limitations of DM? How this can be resolved?
4. For a sinusoidal signal find the condition for no slope overload considering step size Δ and sampling period T_s.
5. What is quantization error? How does it depend upon the step size? Suggest some methods to overcome the difficulties encountered when the modulating signal amplitude swing is very large.
6. Draw the line codes corresponding to the binary data 11011001 for the following: i. Unipolar NRZ, Polar RZ, Bipolar RZ and Manchester coding.
7. A communication channel of bandwidth 75 KHz is required to transmit binary data at a rate of 0.1 Mbps using raised cosine pulses. Determine the roll-off factor.
8. Explain with suitable block diagram the transmitter and receiver part of Adaptive Delta Modulation.
9. A sinusoidal voice signal $x(t) = \cos(6000\pi t)$ is to be transmitted using either PCM or DM. The sampling rate for PCM system is 8kHz and for the transmission with DM, the step size Δ is decided to be of 31.25mV. The slope overload distortion is to be avoided. Assuming that the number of Quintization levels for a PCM System is 64. Determine the signaling rates of both these systems.

Write Short notes on:

i. EYE pattern
ii. Match filter
iii. Regenerative repeater
iv. Differential encoding
v. Zero forcing equalizer
vi. Adaptive delta modulation

MCQ: Type-1 (Maximum marks to be allotted =1)

i)   The bandwidth of BPSK is
    a) fb   b) 2fb   c) 3fb   d) fb/2

ii) The distance between two points of BASK is
    a) $\sqrt{Eb}$ b) $\sqrt{2Eb}$ c) $\sqrt{3Eb}$ d) $\sqrt{4Eb}$

iii) Which one is called ON-OFF keying
    a) BASK   b) BPSK   c) BFSK   d)QPSK

iv) Symbol duration of QPSK is….
    a) Tb   b) 2Tb   c) 3Tb   d) Tb/2

v) Number of bits per symbol of QPSK is
    a) 2   b)3   c)4   d) 1

vi) QPSK is a modulation scheme where each symbol consists of

    a) 4 bits   b) 2 bits   c) 1 bit
    d) M number of bits, depending upon the requirement

vii) The data rate of QPSK is _____ of BPSK.

    a) Thrice   b) Four times   c) Twice   d) same

viii) QPSK system uses a phase shift of

    a) Π   b) Π/2   c) Π/4   d) 2Π

ix) In On- Off keying, the carrier signal is transmitted with signal value 1 and '0' indicates

    a) No carrier   b) Half the carrier amplitude
    c) Amplitude of modulating signal   d) None of the above

x) ASK modulated signal has the bandwidth

    a) Same as the bandwidth of baseband signal   b) Half the bandwidth of baseband signal
    c) Double the bandwidth of baseband signal   d) None of the above

xi) Coherent detection of binary ASK signal requires

    a) Phase synchronization   b) Timing synchronization
    c) Amplitude synchronization   d) Both a) and b

xii) The bandwidth of BFSK is _____ than BPSK.

    a) Lower   b) Same   c) Higher   d) Not predictable

xiii) In Binary FSK, mark and space respectively represent

    a) 1 and 0   b) 0 and 1   c) 11 and 00   d) 00 and 11

xiv) The frequency shifts in the BFSK usually lies in the range

    a) 50 to 1000 Hz   b) 100 to 2000 Hz
    c) 200 to 500 Hz   d) 500 to 10 K Hz

xv) The spectrum of BFSK may be viewed as the sum of

    a) Two ASK spectra   b) Two PSK spectra
    c) Two FSK spectra   d) None of the above

xvi) The maximum bandwidth is occupied by

    a) ASK   b) BPSK   c) FSK   d) None of the above

Short Question (Type-2): (Maximum marks to be allotted =2)

1. Explain coherent detection?
2. What is the major advantage of coherent PSK over coherent ASK?
3. What is the role of an equalizer?
4. What is Nyquist criterion for Inter-symbol interference?
5. How many phases are transmitted in DPSK?
6. What is the symbol duration of DPSK?
7. What is bandwidth of DPSK?
8. Express QPSK mathematically.
9. What do you mean by orthogonal BFSK?
10. What is bandwidth of BFSK?
11. Express ASK, PSK mathematically.

Subjective Question (Type-3): (Maximum marks to be allotted =3)

1. Describe ASK demodulation through coherent detection.
2. Why DPSK scheme of carrier modulation used? Compare bandwidth of QPSK and BPSK.
3. What is the difference between MSK and GMSK?
4. What are the advantages and disadvantages of DPSK?
5. How BFSK scheme is different from BPSK
6. Mention four metrics for good digital modulation scheme.
7. Compare the power spectra of MSK and QPSK
8. Compare the bandwidth and probability of error of 16 MPSK with QASK.
9. Write short notes on Gaussian Minimum Shift Keying (GMSK).
10. Explain how QPSK system requires minimum bandwidth?
11. Distinguish between offset QPSK and non-offset QPSK.
12. What are coherent BFSK and non-coherent BFSK?

Broad Question (Type-4): (Maximum marks to be allotted =5)

1. Why DPSK scheme is used? Compare the bandwidth and probability of error of BPSK, QPSK, BFSK
2. Draw the block diagram of QPSK transmitter and receiver and explain its operation. Show its State Space Representation.
3. Explain the generation and detection method of BFSK Signal.
4. Sketch the waveform of QPSK and Quadrature component of QPSK for the binary sequences 11010110.
5. For the data bit 1100110001, Draw the waveform of ASK,PSK,FSK,QPSF

6. What is the error probability of MSK & DPSK?

Write short notes on:

i)   Error Vector Magnitude (EVM)
ii)   Eye Pattern and Relative Constellation Error (RCE)
iii)   Vector Signal Analyzer (VSA)
iv)   Orthogonal Frequency Division Multiplexing (OFDM)