

**CS/B.Tech/ECE/New/SEM-6/EC-601/2013**  
**2013**  
**DIGITAL COMMUNICATION**

Time Allotted : 3 Hours

Full Marks : 70

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words  
as far as practicable.*

**GROUP - A**

**( Multiple Choice Type Questions )**

1. Choose the correct alternatives for any ten of the following :

$10 \times 1 = 10$

i) A random variable is determined by a large number of independent events that tends to have a Gaussian probability distribution. This can be described using

- a) Central limit theorem
- b) Superposition
- c) Convolution
- d) Correlation.

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ii) An ergodic random process is one which has the property that

- a) ensemble average is constant
- b) time average varies with time
- c) ensemble average constant but time average varies with time
- d) ensemble average and time average are equal.

iii) The main advantage of PCM system is

- a) possibility of TDM
- b) less channel bandwidth
- c) less transmission power
- d) better noise performance.

iv) To avoid aliasing, what is the Nyquist rate of the signal

$$x(t) = 8 \cos(200\pi t) ?$$

- a) 50 Hz
- b) 100 Hz
- c) 200 Hz
- d) 400 Hz.

- v) The use of non-uniform quantization leads to
- a) reduction to transmission BW
  - b) increase in maximum SNR
  - c) increase in SNR for low level signals
  - d) simplification of quantization process.
- vi) Regenerative repeaters can be used in
- a) analog communication system only
  - b) digital communication system only
  - c) analog & digital communication systems
  - d) none of these.
- vii) The spectral density of white noise is
- a) Exponential
  - b) Uniform
  - c) Poisson
  - d) Gaussian.

- viii) Adaptive delta modulation is preferred over delta modulation as
- a) it gives better noise performance
  - b) it uses lesser bits for encoding the signal
  - c) it does not suffer from slope overload and threshold effect
  - d) it has simpler circuitry.
- ix) For generation of FSK the data pattern must be given in
- a) RZ format
  - b) NRZ format
  - c) Split phase Manchester
  - d) none of these.
- x) Which of the digital modulation techniques is used for high speed telephone modems ?
- a) QAM
  - b) GMSK
  - c) QPSK
  - d) GFSK.

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xi) The bit rate of a digital communication system is 34 Mbps. The modulation scheme is QPSK. The baud rate of the system is

- a) 68 Mbps                      b) 34 Mbps  
c) 17 Mbps                      d) 85 Mbps.

xii) Eye pattern is used to study

- a) ISI                              b) Quantization noise  
c) Error rate                      d) None of these.

**GROUP - B****( Short Answer Type Questions )**

Answer any *three* of the following.       $3 \times 5 = 15$

2. State the reason of importance of Gaussian random variable.  
What is error function ?                       $2 + 3$
3. Write down sampling theorem. Discuss different methods of sampling.                       $2 + 3$
4. For the data bit 10110001, draw the waveforms for ASK, FSK, PSK, QPSK.
5. How is orthogonality of two signals defined ? Explain the term 'norm of the signal' ? What is physical significance ?  
 $2 + 2 + 1$

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6. 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.                       $1 + 2 + 2$

**GROUP - C****( Long Answer Type Questions )**

Answer any *three* of the following.       $3 \times 15 = 45$

7. a) What is conditional probability ?  
b) Differentiate between random variable and random process with suitable example.      **10.**  
c) State Central limit theorem.  
d) Prove the Gram-Schmidt orthogonalization procedure.  
e) Discuss the property of auto-correlation functions.      **11.**

 $2 + 3 + 2 + 5 + 3$ 

8. a) With neat block diagram, explain the generation & reception of Delta Modulation ( DM ).  
b) What are the limitations of DM ? How these can be solved ?  
c) For a sinusoidal signal (  $A \cos \omega t$  ), find the condition for no slope overload, if step size is  $\Delta$  & sampling period is  $T_s$ .                       $6 + ( 3 + 2 ) + 4$

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9. a) Draw the block diagram of a QPSK transmitter and receiver and explain the generation of QPSK signal. Show its State Space Representation.
- b) Compare the bandwidth and probability of error of 16 MPSK with QASK.
- c) List the advantages and disadvantages of DPSK Modulation technique.  $2 + 5 + 2 + 3 + 3$
10. a) What is Nyquist criterion for Inter-symbol Interference ?
- b) What are the limitations of ideal solution and how it can be solved with the help of Raised Cosine Function ?
- c) Write a short note on zero forcing equalizer.  $5 + 5 + 5$
11. Write short notes on any *three* of the following :  $3 \times 5$
- a) Matched filter
- b) Adaptive delta modulator
- c) Pulse time modulation
- d) Regenerative repeater
- e) Eye pattern.