



Maratha Vidya Prasarak Samaj's

Rajarshi Shahu Maharaj Polytechnic, Nashik

Udoji Maratha Boarding Campus, Near Pumping Station, Gangapur Road, Nashik-13.

Affiliated to MSBTE Mumbai, Approved by AICTE New Delhi, DTE Mumbai & Govt. of Maharashtra, Mumbai.

***Subject: - Digital Communication System
(22428)***



SYLLABUS

Chapter No.	Name of chapter	Marks With Option
1	Digital Communication system& Coding methods	26
2	Pulse Code Modulation Technique	24
3	Digital Modulation Technique	24
4	Multiplexing & Multiple Access Techniques	16
5	Spread Spectrum Modulation	12
Total Marks :-		102



BOARD THEORY PAPER PATTERN

For DCS(22428)

Q.1		Attempt any FIVE	5*2=10
	a)	State any 4 advantages of digital communication over analog communication.	
	b)	State sampling theorem.	
	c)	Define the term Bit rate, Baud rate	
	d)	State the need of multiplexing.	
	e)	What is spread spectrum modulation?	
	f)	Classify multiple access techniques	
	g)	Draw constellation diagram of 4 QAM & 8 QAM	
Q.2		Attempt any THREE	3*4=12
	a)	Describe slope overload & granular noise in DM technique	
	b)	Encode binary sequence 10110110 using unipolar – RZ, polar – NRZ, AMI and Differential Manchester line coding techniques.	
	c)	Explain M-Ary FSK modulation	
	d)	Draw & explain T hierarchy	
Q.3		Attempt any THREE	3*4=12
	a)	Explain synchronous TDM method with neat diagram.	
	b)	Draw the block diagram of PCM receiver with the help of relevant waveform and explain its working.	
	c)	Explain digital communication system with the help of block diagram.	
	d)	Compare ASK,FSK,PSK	
Q.4		Attempt any FOUR	3*4=12
	a)	Compare TDMA,FDMA,CDMA	
	b)	Explain spread spectrum modulation technique with neat diagram.	
	c)	Generate CRC code for data word 1101101001 by using divisor as 1101. State two advantages of CRC method.	
	d)	What is role of predictor in DPCM?	
	e)	State Shannon's Hartley channel capacity theorem	
Q.5		Attempt any TWO	2*6=12
	a)	State sampling theorem. Explain natural sampling with neat diagram.	
	b)	Define PN sequence. Explain PN sequence generator to generate PN	



Maratha Vidya Prasarak Samaj's
Rajarshi Shahu Maharaj Polytechnic, Nashik

Udoji Maratha Boarding Campus, Near Pumping Station, Gangapur Road, Nashik-13.
Affiliated to MSBTE Mumbai, Approved by AICTE New Delhi, DTE Mumbai & Govt. of Maharashtra, Mumbai.

		sequence of length 7 & 15.
	c)	Draw & explain QPSK transmitter & receiver. Also draw waveform of QPSK for the data 11101001
Q.6		Attempt any TWO 2*6=12
	a)	Draw the neat block diagram of QAM system, explain its working.
	b)	Given a channel with an internal capacity of 20Mbits/sec. The B.W. of this channel is 3MHz. What is the S/N ratio required in order to achieved this capacity
	c)	Justify that in DPCM system, less number of bits are transmitted than PCM system with the help of block diagram and relevant waveform.



CLASS TEST - I

PAPER PATTERN

Syllabus:-

Unit No.	Name of the Unit	Course Outcome (CO)
1	Digital Communication system& Coding methods	428.1
2	Pulse Code Modulation Technique	428.2
Q.1	Attempt any FOUR 4*2=8Marks	Course Outcome (CO)
a)	Define Bit rate & Baud Rate.	428.1
b)	List out Any 2 advantages & disadvantages of digital communication system	428.1
c)	Define Nyquist Rate & Nyquist interval	428.2
d)	Define Companding & Draw its curve	428.2
e)	State Shannon's Hartley channel capacity theorem.	428.1
Q.2	Attempt any THREE 3*4=12 Marks	
a)	State Sampling theorem & describe different types of sampling techniques. [CO-2]	428.2
b)	Draw the waveform for the bit stream 1100010101 using a. UPRZ b. BPRZ c. AMI d. Manchester [CO-1]	428.1
c)	Draw & explain PCM transmitter with neat diagram [CO-2]	428.2
d)	Explain Hamming code for one bit error detection with example for the data 1101 [CO-1]	428.1



CLASS TEST - II

PAPER PATTERN

Syllabus:-

Unit No.	Name of the Unit	Course Outcome (CO)
3	Digital Modulation Technique	428.3
4	Multiplexing & Multiple Access Techniques	428.4
5	Spread Spectrum Modulation	428.5
Q.1	Attempt any FOUR 4*2=8Marks	Course Outcome (CO)
a)	State any 2 advantages and applications of spread spectrum modulation.	428.5
b)	List any 2 advantages of M-array signaling over binary signaling.	428.3
c)	State need of multiplexing	428.4
d)	List different types of multiple access techniques	428.4
e)	Draw constellation diagram for 4 QAM & 8 QAM.	428.3
Q.2	Attempt any THREE 3*4=12 Marks	
a)	Draw & explain QAM	428.3
b)	Draw the circuit diagram of PN sequence generator for generating PN sequence of length 7. Assuming initial content of the shift register to be all ones, explain its working. Generate output sequence	428.5
c)	Draw & explain FDMA	428.4
d)	Explain QPSK modulation with example	428.3



Maratha Vidya Prasarak Samaj's

Rajarshi Shahu Maharaj Polytechnic, Nashik

Udoji Maratha Boarding Campus, Near Pumping Station, Gangapur Road, Nashik-13.

Affiliated to MSBTE Mumbai, Approved by AICTE New Delhi, DTE Mumbai & Govt. of Maharashtra, Mumbai.

COURSE OUTCOME (CO)

COURSE: - Digital Communication System (22428)

PROGRAMME: - EJ

CO.NO	Course Outcome
CO-428.1	Analyze various error detection & correction codes in digital communication system
CO-428.2	Use Various pulse code modulation techniques
CO-428.3	Maintain the system based on digital modulation technique
CO-428.4	Multiplex & DE multiplex various digital signals
CO-428.5	Maintain spread spectrum based system



1. Digital Communication System & Coding Methods

Position in Question Paper

Total Marks-18

Q.1. d) 2-Marks.

Q.2. b) 4-Marks.

Q.5. b) 6-Marks.

Q.6. a) 3-Marks

Q.6. c) 3-Marks

Descriptive Question

1. State any 4 advantages & disadvantages of digital communication over analog communication.
2. Draw & explain block diagram of digital communication system
3. Compare analog & digital communication.
4. Define the following term
 - a. Bit rate
 - b. Baud rate
 - c. Channel capacity
 - d. Entropy
 - e. Information rate
 - f. Hamming weight
 - g. Hamming distance
 - h. Code rate
5. State Shannon's Hartley channel capacity theorem
6. What are different types of errors in digital communication? State its example
7. List various error detection methods & explain any one in detail with example.
8. Given a channel with an internal capacity of 20Mbits/sec. The B.W. of this channel is 3MHz. What is the S/N ratio required in order to achieved this capacity
9. Similar numerical on channel capacity
10. Numerical on Huffman coding
11. Numerical on Hamming code
12. Numerical on CRC
13. Numerical on line coding

MCQ Question

(Total number of Question=Marks*3=18*3=54)

Note: Correct answer is marked with **bold**

1. Digital communication is _____ to environmental changes?
 - a) **Less sensitive**
 - b) More sensitive
 - c) Does not depend
 - d) None of the mentioned
2. Advantages of digital communication are



- a) Easy multiplexing
b) Easy processing
3. What is necessary for digital communication?
a) Precision timing
b) Frame synchronization
4. What are the disadvantages of digital communication?
a) Needs more bandwidth
b) Is more complex
c) Needs more bandwidth & Is more complex
d) None of the mentioned
5. Examples of digital communication are
a) ISDN
b) Modems
6. Digital system includes
a) Better encryption algorithm
b) Difficult data multiplexing
7. Analog to digital conversion includes
a) Sampling
b) Quantization
8. The capacity relationship is given by
a) $C = W \log_2 (1+S/N)$
b) $C = 2W \log_2 (1+S/N)$
9. Entropy is the measure of
a) Amount of information at the output
b) Amount of information that can be transmitted
c) Number of error bits from total number of bits
d) None of the mentioned
10. Average effective information is obtained by
a) Subtracting equivocation from entropy
b) Adding equivocation with entropy
c) Ratio of number of error bits by total number of bits
d) None of the mentioned
11. Binary Huffman coding is a
a) Prefix condition code
b) Suffix condition code
12. The method of converting a word to stream of bits is called as
a) Binary coding
b) Source coding
13. When the base of the logarithm is 2, then the unit of measure of information is
a) Bits
b) Bytes
14. The self-information of random variable is
a) Easy multiplexing
b) Easy processing
c) Reliable
d) All of the mentioned
- c) Character synchronization
d) All of the mentioned
- c) Classical telephony
d) All of the mentioned
- c) All of the mentioned
d) None of the mentioned
- c) Sampling & Quantization**
d) None of the mentioned
- c) $C = W \log_2 (1+S/N)$
d) $C = W \log_{10} (1+S/N)$
- c) Prefix & Suffix condition code
d) None of the mentioned
- c) Bit coding
d) Cipher coding
- c) Nats
d) None of the mentioned



- a) 0
b) 1
15. Entropy of a random variable is
a) 0
b) 1
16. Hamming distance can be given by the number of elements in which
a) They are same
b) They differ
c) Infinite
d) cannot be determined
17. Code strength is characterized by its
a) Minimum distance
b) Maximum distance
c) Code weight
d) Code size
18. The distance between two code-words is equal to the _____ of the third code-word which is the sum of the first two code-words.
a) Size
b) Weight
c) Minimum distance
d) None of the mentioned
19. Error detecting capability is given as
a) $D_{min} + 1$
b) $D_{min} - 1$
c) D_{min}
d) $D_{min}/2$
20. The minimum distance D_{min} can also be given as
a) $D_{min} \geq \alpha + \beta + 1$
b) $D_{min} \leq \alpha + \beta + 1$
c) $D_{min} \geq \alpha + \beta - 1$
d) $D_{min} \leq \alpha + \beta + 1$
21. For better efficiency and simplicity, n should be
a) Maximum
b) Minimum
c) Zero
d) Infinity
22. Which needs re-sending of signal?
a) Error correction
b) Error detection
c) Error correction & detection
d) None of the mentioned
23. Which needs more check bits?
a) Error correction
b) Error detection
c) Error correction & detection
d) None of the mentioned
24. Which gets less affected by noise?
a) Error correction
b) Error detection
c) Error correction & detection
d) None of the mentioned
25. Digital signals are easy for
a) Storage
b) Handling
c) Time dilation
d) All of the mentioned
26. Which has better minimum distance?
a) Check sum
b) Cyclic redundancy check
c) Check sum & Cyclic redundancy check
d) None of the mentioned
27. Expected information contained in message is called as
a) Entropy
b) Efficiency



- c) Code signal
28. Entropy is called as
a) **Average information per message**
b) Amplitude
29. Information rate R for given average information $H=2.0$ for analog signal bandlimited to B Hz is
a) 8B bits/sec
b) **4B bits/sec**
30. On which factor/s do/does the channel capacity depend/s in the communication system?
a) Bandwidth
b) Signal to Noise Ratio
31 For M equally likely messages, the average amount of information H is
a) $H = \log_{10}M$
b) **$H = \log_2M$**
32. The channel capacity is
a) **The maximum information transmitted by one symbol over the channel**
b) Information contained in a signal
c) The amplitude of the modulated signal
d) All of the above
33. According to Shannon Hartley theorem,
a) The channel capacity becomes infinite with infinite bandwidth
b) The channel capacity does not become infinite with infinite bandwidth
c) Has a tradeoff between bandwidth and Signal to noise ratio
d) **Both b and c are correct**
34. The negative statement for Shannon's theorem states that
a) If $R > C$, the error probability increases towards Unity
b) If $R < C$, the error probability is very small
c) **Both a & b**
d) None of the above
35. For M equally likely messages, $M \gg 1$, if the rate of information $R \leq C$, the probability of error is
a) **Arbitrarily small**
b) Close to unity
36. For M equally likely messages, $M \gg 1$, if the rate of information $R > C$, the probability of error is
a) **Arbitrarily small**
b) Close to unity
37. The channel capacity according to Shannon's equation is
a) Maximum error free communication
b) Defined for optimum system
d) None
c) Information in signal
d) All of the above mentioned
c) 2B bits/sec
d) 16B bits/sec
c) Both a and b
d) None of the above
c) $H = \log_{10}M^2$
d) $H = 2\log_{10}M$
c) Not predictable
d) Unknown
c) Not predictable
d) Unknown
c) Information transmitted
d) **All of the above**



38. Code rate r , k information bits and n as total bits, is defined as
- a) $r = k/n$
 - b) $k = n/r$
 - c) $r = k * n$
 - d) $n = r * k$
39. The relation between entropy and mutual information is
- a) $I(X;Y) = H(X) - H(X/Y)$
 - b) $I(X;Y) = H(X/Y) - H(Y/X)$
 - c) $I(X;Y) = H(X) - H(Y)$
 - d) $I(X;Y) = H(Y) - H(X)$
40. For a (7, 4) block code, 7 is the total number of bits and 4 is the number of
- a) **Information bits**
 - b) Redundant bits
 - c) Total bits- information bits
 - d) None of the above
41. Parity bit coding may not be used for
- a) Error in more than single bit
 - b) Bit is in error
 - c) **Both a & b**
 - d) None of the above
42. Parity check bit coding is used for
- a) Error correction
 - b) **Error detection**
 - c) Error correction and detection
 - d) None of the above
43. For hamming distance d_{\min} and t errors in the received word, the condition to be able to correct the errors is
- a) $2t + 1 \leq d_{\min}$
 - b) $2t + 2 \leq d_{\min}$
 - c) $2t + 1 \leq 2d_{\min}$
 - d) **Both a and b**
44. For hamming distance d_{\min} and number of errors D , the condition for receiving invalid codeword is
- a) $D \leq d_{\min} + 1$
 - b) **$D \leq d_{\min} - 1$**
 - c) $D \leq 1 - d_{\min}$
 - d) $D \leq d_{\min}$
45. Unipolar, bipolar, and polar encoding are types of _____ encoding.
- a) **line**
 - b) block
 - c) nrz
 - d) manchester
46. The idea of RZ and the idea of NRZ-L are combined into the _____ scheme.
- a) **Manchester**
 - b) differential manchester
 - c) both (a) and (b)
 - d) neither (a) nor (b)
47. In _____ encoding, we use three levels: positive, zero, and negative.
- a) unipolar
 - b) polar
 - c) **bipolar**
 - d) none of the above
48. _____ encoding has a transition at the beginning of each 0 bit.
- a) **differential manchester**
 - b) manchester
 - c) rz
 - d) all the above
49. In a uni-polar RZ format,
- a) The waveform has zero value for symbol '0'
 - b) The waveform has A volts for symbol '1'
 - c) The waveform has positive and negative values for '1' and '0' symbol respectively
 - d) **Both a) and b) are correct**
50. Which type is used and preferred in digital logic circuits?
- a) **NRZ-L**
 - b) NRZ-M
 - c) NRZ-S
 - d) None of the mentioned



51. Which method is called as differential encoding?
a) NRZ-L
b) NRZ-M
c) NRZ-S
d) None of the mentioned
52. Which method is preferred in magnetic tape recording?
a) NRZ-L
b) NRZ-M
c) NRZ-S
d) None of the mentioned
53. The return to zero waveform consists of
a) Unipolar RZ
b) Bipolar RZ
c) RZ-AMI
d) All of the mentioned
54. In which waveform logic 1 is represented by half bit wide pulse and logic 0 is represented by absence of pulse?
a) Unipolar RZ
b) Bipolar RZ
c) RZ-AMI
d) Manchester coding
55. In which waveform logic 1 and logic 0 are represented by opposite one half bit wide pulses?
a) Unipolar RZ
b) Bipolar RZ
c) RZ-AMI
d) Manchester coding
56. 12. In which waveform logic 1 is represented by equal amplitude alternating pulses?
a) Unipolar RZ
b) Bipolar RZ
c) RZ-AMI
d) Manchester coding



2. Digital Modulation Technique

Position in Question Paper

Total Marks-16

Q.1 a) 2-Marks.

Q.1 b) 2-Marks.

Q.1 c) 2-Marks.

Q.1 e) 2-Marks.

Q.3 a) 4-Marks.

Q.4 a) 4-Marks.

Descriptive Question

1. State Sampling theorem
2. Describe different types of sampling techniques
3. Define the terms:-
 - a. Nyquist rate
 - b. Nyquist interval
 - c. Aliasing error
4. Explain quantization process with neat waveform
5. What is companding? Draw its curve.
6. Draw & explain PCM transmitter & state any 2 advantages & disadvantages.
7. What is role of predictor in DPCM?
8. Draw block diagram of DM transmitter & explain the same.
9. Explain slope overload & granular noise in DM. How slope overload can be reduced.
10. Compare PCM, DM, ADM & DPCM.
11. Compare analog & digital pulse modulation.
12. Explain working of ADM with neat diagram.

MCQ Question

(Total number of Question=Marks*3=16*3=48)

Note: Correct answer is marked with **bold**

1. Non uniform quantization includes
 - a) Compression
 - b) Expansion
 - c) Compression & Expansion**
 - d) None of the mentioned
2. Different cases of sampling include
 - a) Ideal impulse sampling
 - b) Flat-topped sampling
 - c) Sampling with rectangular pulses**
 - d) All of the mentioned**
3. To avoid aliasing
 - a) Reduce the bandwidth
 - b) Cut out high frequency
 - c) Reduce the bandwidth & Cut out high frequency**
 - d) None of the mentioned
4. A to D conversion process uses



- a) Sampler
b) Quantizer
5. The sampling process includes methods such as
a) Filtering
b) Sample and hold
c) Amplifying
d) None of the mentioned
6. The output of sampling process are called as _____
a) Pulse code modulation
b) Pulse amplitude modulation
c) Frequency modulation
d) Amplitude modulation
7. The process in which the top of each pulse in the output samples retains the shape of the analog segment is called as _____
a) **Natural sampling**
b) Ideal sampling
c) Aliasing
d) None of the mentioned
8. Aliasing can be removed using
a) Prefiltering
b) Postfiltering
c) Prefiltering & Postfiltering
d) None of the mentioned
9. Flat top sampling or practical sampling has
a) Same frequency
b) Same amplitude
c) Same time difference
d) None of the mentioned
10. Multiplication of input signal with pulse train is done in _____ sampling.
a) Impulse sampling
b) Natural sampling
c) Flat top sampling
d) None of the mentioned
11. The signals which are obtained by encoding each quantized signal into a digital word is called as
a) PAM signal
b) PCM signal
c) FM signal
d) Sampling and quantization
12. Quantization noise can be reduced by _____ the number of levels.
a) Decreasing
b) Increasing
c) Doubling
d) Squaring
13. In PCM encoding, quantization level varies as a function of _____
a) Frequency
b) Amplitude
c) Square of frequency
d) Square of amplitude
14. In PCM the samples are dependent on _____
a) **Time**
b) Frequency
c) Quantization level
d) Interval between quantization level
15. DPCM encodes the PCM values based on
a) Quantization level
b) Difference between the current and predicted value
c) Interval between levels
d) None of the mentioned
16. Delta modulation uses _____ bits per sample.
a) **One**
b) Two
c) Four
d) Eight
17. The modulation techniques used to convert analog signal into digital signal are



- a) Pulse code modulation
b) Delta modulation
18. The sequence of operations in which PCM is done is
a) **Sampling, quantizing, encoding**
b) Quantizing, encoding, sampling
19. In PCM, the parameter varied in accordance with the amplitude of the modulating signal is
a) Amplitude
b) Frequency
20. One of the disadvantages of PCM is
a) **It requires large bandwidth**
b) Very high noise
21. In Differential Pulse Code Modulation techniques, the decoding is performed by
a) **Accumulator**
b) Sampler
22. 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**
23. DPCM suffers from
a) slope over load distortion
b) quantization noise
24. In Delta modulation,
a) One bit per sample is transmitted
b) All the coded bits used for sampling are transmitted
c) The step size is fixed
d) **Both a) and c) are correct**
25. In digital transmission, the modulation technique that requires minimum bandwidth is
a) **Delta modulation**
b) PCM
26. In Delta Modulation, the bit rate is
a) **N times the sampling frequency**
b) N times the modulating frequency
27. In Adaptive Delta Modulation, the slope error reduces and
a) Quantization error decreases
b) **Quantization error increases**
28. The digital modulation scheme in which the step size is not fixed is
a) Delta modulation
b) **Adaptive delta modulation**
29. The digital modulation technique in which the step size is varied according to the variation in the slope of the input is called
- c) Adaptive delta modulation
d) **All of the above**
- c) Quantizing, sampling, encoding
d) None of the above
- c) Phase
d) **None of the above**
- c) Cannot be decoded easily
d) All of the above
- c) PLL
d) Quantizer
- c) **both a) and b)**
d) none of the above
- c) N times the nyquist criteria
d) None of the above
- c) Quantization error remains same
d) None of the above
- c) DPCM
d) PAM



- a) Delta modulation
b) PCM
30. 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
31. 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
32. The noise that affects PCM
a) Transmission noise
b) Quantizing noise
c) Transit noise
d) Both a and b are correct
33. DPCM suffers from
a) Slope over load distortion
b) Quantization noise
c) **Both a & b**
d) None of the above
34. 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
35. In Differential Pulse Code Modulation techniques, the decoding is performed by
a) **Accumulator**
b) Sampler
c) PLL
d) Quantizer
36. The error probability of a PCM is
a) Calculated using noise and inter symbol interference
b) Gaussian noise + error component due to inter symbol interference
c) Calculated using power spectral density
d) All of the above
37. 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
38. 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
39. The process of converting the analog sample into discrete form is called
a) Modulation
b) Multiplexing
c) **Quantization**
d) Sampling
40. 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
41. The demodulator in delta modulation technique is
a) Differentiator
b) Integrator
c) Quantizer
d) None of the mentioned
42. Source of noise in delta modulation is
a) Granularity
b) Slope overload
c) Granularity & Slope overload
d) None of the mentioned
43. In channel encoding procedure
a) Redundancy bits are added
b) Errors are corrected
c) Redundancy bits are added & Errors are corrected
d) None of the mentioned
44. Delta modulation is
a) 1 bit DPCM
b) 2 bit DPCM
c) 4 bit DPCM
d) None of the mentioned
45. 1 bit quantizer is a
a) Hard limiter
b) Two level comparator
c) Hard limiter & Two level comparator
d) None of the mentioned
46. If step size is increased _____ occurs.
a) Slope overload distortion
b) Granular noise
c) Slope overload distortion & Granular noise
d) None of the mentioned
47. Which helps in maintaining the step size?
a) Delta modulation
b) PCM
c) DPCM
d) Adaptive delta modulation
48. The low pass filter at the output end of delta modulator depends on
a) Step size
b) Quantization noise
c) Bandwidth
d) None of the mentioned



3. Digital Modulation Technique

Position in Question Paper

Total Marks-16

Q.1 a) 2-Marks.

Q.1 b) 2-Marks.

Q.1 c) 2-Marks.

Q.1 e) 2-Marks.

Q.3 a) 4-Marks.

Q.4 b) 4-Marks.

Descriptive Question

1. List out different modulation techniques & explain ASK with suitable diagram & waveform
2. Explain function of FSK & PSK
3. Compare ASK, FSK & PSK
4. Explain generation of DPSK with neat diagram
5. What is constellation diagram & draw constellation diagram
ASK, PSK, QPSK, 4QAM, 8QAM, 16QAM
6. Draw & explain QPSK transmitter & receiver. Also draw waveform of QPSK for the data 11101001
7. Draw & explain QAM
8. Compare all type of digital modulation techniques
BPSK, FSK, QPSK, DPSK, ASK, QAM, M-ary
9. Draw power spectral density of ASK, PSK, FSK, QPSK, QAM

MCO Question

(Total number of Question=Marks*3=16*3=48)

Note: Correct answer is marked with **bold**

1. 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
2. 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
3. The data rate of QPSK is _____ of BPSK.
 - a) Thrice
 - b) Four times
 - c) Twice**
 - d) same
4. QPSK system uses a phase shift of



- a) Π c) $\Pi/4$
b) $\Pi/2$ d) 2Π
5. The bandwidth of BFSK is _____ than BPSK.
a) Lower c) **Higher**
b) Same d) Not predictable
6. In Binary FSK, mark and space respectively represent
a) **1 and 0** c) 11 and 00
b) 0 and 1 d) 00 and 11
7. The frequency shifts in the BFSK usually lies in the range
a) **50 to 1000 Hz** c) 200 to 500 Hz
b) 100 to 2000 Hz d) 500 to 10 K Hz
8. The spectrum of BFSK may be viewed as the sum of
a) **Two ASK spectra** c) Two FSK spectra
b) Two PSK spectra d) None of the above
9. The maximum bandwidth is occupied by
a) ASK c) **FSK**
b) BPSK d) None of the above
10. Minimum shift keying is similar to
a) **Continuous phase frequency shift keying**
b) Binary phase shift keying
c) Binary frequency shift keying
d) QPSK
11. FSK reception is
a) Phase Coherent c) **Phase Coherent & non coherent**
b) Phase non coherent d) None of the mentioned
12. QAM uses _____ as the dimensions.
a) In phase c) **In phase & Quadrature**
b) Quadrature d) None of the mentioned
13. In QAM, both phase and _____ of a carrier frequency are varied.
a) Frequency c) **Amplitude**
b) Bit rate d) Baud rate
14. Which of the following is most affected by noise?
a) PSK c) QAM
b) FSK d) **ASK**
15. ASK, PSK, FSK, and QAM are examples of _____ modulation.
a) Analog-to-analog c) Digital-to-digital
b) Analog-to-digital d) **Digital-to-analog**
16. As the bit rate of an FSK signal increases, the bandwidth _____.
a) Remains the same c) **Increases**
b) Decreases d) Doubles
17. In 16-QAM, there are 16 _____.
a) Phases c) Amplitudes
b) **Combinations of phase and amplitude** d) bps



18. Which modulation technique involves tribits, eight different phase shifts, and one amplitude?
- a) FSK
b) ASK
c) 4-PSK
d) **8-PSK**
19. In BPSK, the _____ of constant amplitude carrier signal is switched between two values according to the two possible values.
- a) Amplitude
b) **Phase**
c) Frequency
d) Angle
20. QPSK provides twice the bandwidth efficiency and _____ energy efficiency as compared to BPSK.
- a) Twice
b) Half
c) **Same**
d) Four times
21. How many carrier frequencies are used in BPSK?
- a) 0
b) 1
c) **2**
d) none of the above
22. The constellation diagram of 16-QAM has _____ dots.
- a) 4
b) 8
c) **16**
d) none of the above
23. How many carrier frequencies are used in QPSK?
- a) 0
b) **2**
c) 1
d) none of the above
24. Which of the following is not a digital-to-analog conversion?
- a) FSK
b) ASK
c) **AM**
d) PSK
25. Which of the following is not an analog-to-analog conversion?
- a) **QAM**
b) AM
c) PM
d) FM
26. The constellation diagram of BPSK has _____ dots.
- a) 0
b) 1
c) **2**
d) none of the above
27. The constellation diagram of QPSK has _____ dots.
- a) **4**
b) 2
c) 1
d) none of the above
28. In _____, the peak amplitude of one signal level is 0; the other is the same as the amplitude of the carrier frequency.
- a) **OOK**
b) PSK
c) FSK
d) none of the above
29. The constellation diagram of BASK has _____ dots.
- a) 0
b) 1
c) **2**
d) none of the above
30. How many carrier frequencies are used in BFSK?
- a) **2**
b) 1
c) 0
d) none of the above



31. In QAM, both _____ of a carrier frequency are varied.
- a) phase and frequency
 - b) **amplitude and phase**
 - c) frequency and amplitude
 - d) none of the above
32. _____ uses two carriers, one in-phase and the other quadrature.
- a) **QAM**
 - b) ASK
 - c) FSK
 - d) PSK
33. A constellation diagram shows us the _____ of a signal element, particularly when we are using two carriers (one in-phase and one quadrature).
- a) amplitude and frequency
 - b) **amplitude and phase**
 - c) frequency and phase
 - d) none of the above
34. In _____, the amplitude of the carrier signal is varied to create signal elements. Both frequency and phase remain constant
- a) psk
 - b) ask
 - c) fsk
 - d) qam
35. In _____, the phase of the carrier is varied to represent two or more different signal elements. Both peak amplitude and frequency remain constant.
- a) **PSK**
 - b) FSK
 - c) ASK
 - d) QAM
36. In _____, the frequency of the carrier signal is varied to represent data. Both peak amplitude and phase remain constant.
- a) ASK
 - b) FSK
 - c) PSK
 - d) QAM
37. In an M-ary signalling scheme two or more bits are grouped together to form a _____
- a) Chip
 - b) **Symbol**
 - c) Byte
 - d) Pattern
38. The number of possible signal in M-ary signalling is given by M and $M = \underline{\hspace{2cm}}$ where n is an integer.
- a) n
 - b) 2n
 - c) **2^n**
 - d) n^2
39. In M-ary PSK, the carrier _____ takes one of M possible values.
- a) Amplitude
 - b) Frequency
 - c) Angle
 - d) **Phase**
40. The constellation of M-ary PSK is _____ dimensional.
- a) One
 - b) Does not exist
 - c) **Two**
 - d) Three
41. What is the radius of the circle in M-ary PSK on which message points are equally spaced?
- a) $\sqrt{E_s}$
 - b) $\sqrt{E_b}$
 - c) E_b
 - d) E_s
42. As the value of M _____ the bandwidth efficiency _____
- a) Increases, same.
 - b) Increases, decreases
 - c) **Increases, increases**
 - d) Decreases, same
43. The power efficiency of the M ary PSK decreases because of the _____



- a) Freely packed constellation
b) Increment of bandwidth efficiency
- c) Fixed null bandwidth
d) Densely packed constellation
44. In comparison to M-ary PSK, M-ary QAM bandwidth efficiency is _____ and power efficiency is _____
- a) Identical, superior**
b) Less, superior
c) Identical, identical
d) Superior, superior
45. The bandwidth efficiency of an M-ary FSK signal _____ with _____ in M.
- a) Constant, increase
b) Increases, increase
c) Decreases, increase
d) Decreases, decrease
45. Power efficiency of M-ary FSK increases, since _____
- a) Constellation is densely packed
b) M signals are non-orthogonal
c) Fixed null bandwidth
d) M-signals are orthogona
46. Which modulation technique involves tribits, eight different phase shifts, and one amplitude?
- a) FSK
b) ASK
c) 4-PSK
d) 8-PSK
47. 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
48. The number of possible signal in M-ary signalling is given by M and M = _____ where n is an integer.
- a) n
b) 2n
c) 2^n
d) n^2



4. Multiplexing & Multiple Access Technique

Position in Question Paper

Total Marks-12

Q.1 d) 2-Marks.

Q.1 f) 2-Marks.

Q.3 b) 4-Marks.

Q.4 c) 4-Marks.

Descriptive Question

1. Define multiplexing. State the need of multiplexing & classify it
2. Draw & explain FDM transmitter & receiver. Write its any 2 application.
3. Explain synchronous TDM with neat diagram.
4. Compare FDM, TDM, & CDM
5. Draw & explain PCM-TDM system.
6. Draw AT & T line Hierarchy & FDM Hierarchy.
7. Compare FDMA, TDMA, & CDMA
8. Draw & explain TDMA technique & give its advantages over a FDMA
9. Explain the working principle of CDMA

MCQ Question

(Total number of Question=Marks*3=16*3=48)

Note: Correct answer is marked with **bold**

1. Which is based on orthogonality?
 - a) TDM
 - b) FDM**
 - c) TDM & FDM
 - d) None of the mentioned
2. Which provides constant delay?
 - a) Synchronous TDM**
 - b) Non synchronous TDM
 - c) Synchronous & Non synchronous TDM
 - d) None of the mentioned
3. Which are non orthogonal multiplexing?
 - a) TDM
 - b) FDM
 - c) TDM & FDM
 - d) None of the mentioned**
4. FDM stands for _____
 - a) Frequency Density Multiplexing
 - b) Frequency Difference Multiplexing
 - c) Frequency Division Multiplexing**
 - d) Frequency Data Manager
5. TDM stands for _____
 - a) Time Division Multiplexing**
 - b) Time Difference Multiplexing
 - c) Time Duration Multiplexing
 - d) Time Data Manager
6. What is Synchronous TDM?
 - a) gives same amount of time to each device**
 - b) gives same amount of frequency to each device



- c) gives variable time to each device
d) gives variable frequency to each device
7. FDM is an analog multiplexing technique used to combines _____
a) analog signals
b) digital signals
c) both analog and digital signals
d) alternatively passes analog and digital signals
8. Which multiplexing technique transmits digital signals?
a) FDM
b) TDM
c) WDM
d) Both FDM and TDM
9. To get constant time delay, we should use _____
a) FDM technique
b) WDM technique
c) Synchronous TDM
d) Non synchronous TDM
10. Frequency division multiple access (FDMA) assigns _____ channels to _____ users.
a) Individual, individual
b) Many, individual
c) Individual, many
d) Many, many
11. The FDMA channel carries _____ phone circuit at a time.
a) Ten
b) Two
c) One
d) Several
12. The bandwidth of FDMA channel is _____
a) Wide
b) Narrow
c) Large
d) Zero
13. The symbol time in FDMA systems is _____ thus intersymbol interference is ____
a) Large, high
b) Small, low
c) Small, high
d) Large, low
14. Which of the following is not true for FDMA systems as compared to TDMA systems?
a) Low complexity
b) Lower cell site system cost
c) Tight RF filtering
d) Narrow bandwidth
15. Because of _____ transmissions in TDMA, the handoff process in _____
a) Continuous, complex
b) Continuous, simple
c) Discontinuous, complex
d) Discontinuous, simple
16. In multiple access is achieved by allocating different time slots for the different users.
a) TDMA
b) CDMA
c) FDMA
d) FGMA
17. CDMA stands for:
a) **Code-Division Multiple Access**
b) Carrier Division Multiple Access
c) Compact Digital Multiplex Arrangement
d) none of the above
18. TDMA is used instead of TDM when:
a) all the signals come from the same source
b) the signals come from different sources



- c) TDM is used in RF communications
d) they mean the same thing
19. A DS-1 signal contains:
a) 12 channels
b) **24 channels**
c) 32 channels
d) 64 channels
20. The bit-rate of a DS-1 signal over a T-1 line is:
a) 64 kbps
b) 256 kbps
c) 1.536 Mbps
d) **1.544 Mbps**
21. Besides data bits, a DS-1 frame contains a:
a) timing bit
b) T-bit
c) signaling bit
d) **framing bit**
22. CDMA:
a) cannot be used with frequency-hopping spread-spectrum
b) cannot be used with direct-sequence spread-spectrum
c) cannot be used on an RF channel
d) **allows many transmitters to use a band simultaneously**
23. Multiplexing allows many signals to _____ a channel.
a) Share
b) divide
c) multiplex
d) None
24. Three methods of multiple access are FDMA, TDMA, and _____.
a) CDM
b) CDMA
c) Both a & b
d) None
25. T1 carrier system is used
a) For PCM voice transmission
b) For delta modulation
c) For frequency modulated signals
d) None of the above
26. Due to _____ transmission scheme _____ bits are needed for overhead in FDMA systems.
a) **Continuous, few**
b) Discontinuous, few
c) Continuous, many
d) Discontinuous, many
27. Which of the following is not true for FDMA systems as compared to TDMA systems?
a) Low complexity
b) **Lower cell site system cost**
c) Tight RF filtering
d) Narrow bandwidth
28. _____ is based on FDMA/FDD.
a) GSM
b) W-CDMA
c) Cordless telephone
d) **AMPS**
29. Which of the following is not true for TDMA?
a) **Single carrier frequency for single user**
b) Discontinuous data transmission
c) No requirement of duplexers
d) High transmission rates
30. Because of _____ transmissions in TDMA, the handoff process in _____.
a) Continuous, complex
b) Continuous, simple
c) Discontinuous, complex
d) **Discontinuous, simple**



31. FDMA is the division of
- a) Time
 - b) Phase
 - c) **Spectrum**
 - d) Amplitude
32. Guard band is
- a) **The small unused bandwidth between the frequency channels to avoid interference**
 - b) The bandwidth allotted to the signal
 - c) The channel spectrum
 - d. The spectrum acquired by the noise between the signal
33. **Cable television is an example of**
- a) TDMA
 - b) **FDMA**
 - c) CDMA
 - d) SDMA
34. In FDMA,
- 1. Each user is assigned unique frequency slots
 - 2. Demand assignment is possible
 - 3. Fixed assignment is possible
 - 4. It is vulnerable to timing problems
- a) Only 1) and 2) are correct
 - b) 2) and 4) are correct
 - c) **1), 2) and 3) are correct**
 - d) All four are correct
35. FDMA demand assignment uses
- 1. Single channel per carrier
 - 2. Multi channel per carrier
 - 3. single transmission in one time slot
 - 4. multi transmission in one time slot
- a) **1) and 2) are correct**
 - b) 2), 3), and 4) are correct
 - c) 1), 2), and 3) are correct
 - d) All four are correct
36. The advantages of FDMA over TDMA includes
- 1. Division is simpler
 - 2. Propagation delays are eliminated
 - 3. Cheaper filters with less complicated logic functions
 - 4. Linearity
- a) 1), 2) and 3) are correct
 - b) **1) and 2) are correct**
 - c) 1) and 4) are correct
 - d) All four are correct



5. Spread Spectrum Modulation

Position in Question Paper

Total Marks-08

Q.1 a) 2-Marks.

Q.5 a) 4-Marks.

Q.6 b) 3-Marks.

Descriptive Question

1. What is spread spectrum modulation. Write it's any 4 applications.
2. Define PN sequence. Explain PN sequence generator to generate PN sequence of length 7 & 15.
3. Draw & explain block diagram of spread spectrum modulation.
4. Explain direct sequence spread spectrum transmitter & receiver. Write it's any 2 advantages & disadvantages.
5. Define chip rate & processing gain
6. Describe FH-SS system in details.
7. Draw & explain the block diagram of spread spectrum modulation system.

MCQ Question

(Total number of Question=Marks*3=08*3=24)

Note: Correct answer is marked with **bold**

1. Why spread spectrum technique is inefficient for a single user?
 - a) **Large transmission bandwidth**
 - b) Small transmission bandwidth
 - c) Fixed transmission bandwidth
 - d) Fixed null bandwidth
2. Which of the following is not a property of spread spectrum techniques?
 - a) Interference rejection capability
 - b) **Multipath fading**
 - c) Frequency planning elimination
 - d) Multiple user, multiple access interface
3. Which of the following is not a characteristic of PN sequence?
 - a) Nearly equal number of 0s and 1s
 - b) Low correlation between shifted version of sequence
 - c) **Non deterministic**
 - d) Low cross-correlation between any two sequences
4. The period of a PN sequence produced by a linear m stage shift register cannot exceed _____ symbols.
 - a) 2m
 - b) m
 - c) 2^m
 - d) **2^m-1**
5. DSSS system spreads the baseband signal by _____ the baseband pulses with a pseudo noise sequence.
 - a) Adding
 - b) Subtracting
 - c) **Multiplying**
 - d) Dividing



6. Frequency hopping involves a periodic change of transmission _____
- a) Signal
 - b) **Frequency**
 - c) Phase
 - d) Amplitude
7. What is the set of possible carrier frequencies in FH-SS?
- a) **Hopset**
 - b) Hop
 - c) Chips
 - d) Symbols
8. The bandwidth of the channel used in the hopset is called _____
- a) Hopping bandwidth
 - b) Total hopping bandwidth
 - c) **Instantaneous bandwidth**
 - d) 3 dB bandwidth
9. The processing gain of FH systems is given by ratio of _____
- a) Hopping bandwidth and hopping period
 - b) Instantaneous bandwidth and hopping duration
 - c) 3 dB bandwidth and bit rate
 - d) **Total hopping bandwidth and instantaneous bandwidth**
10. Some advantages of spread spectrum are
- a) Low susceptibility
 - b) Immunity to jamming
 - c) Reduced interference
 - d) **All of the mentioned**
11. Which is better for avoiding jamming?
- a) Direct sequence spread spectrum
 - b) **Frequency hopping spread spectrum**
 - c) Time hopping spread spectrum
 - d) None of the mentioned
12. CDMA rejects
- a) **Narrow band interference**
 - b) Wide band interference
 - c) Narrow & Wide band interference
 - d) None of the mentioned
13. In DSSS the signal is recovered using
- a) Low pass filter
 - b) High pass filter
 - c) **Band pass filter**
 - d) Band stop filter
14. Fast frequency hopping is
- a) Several modulations per hop
 - b) Several modulations per symbol
 - c) Several symbols per modulation
 - d) **None of the mentioned**
15. The frequency hopping system uses _____ modulation scheme.
- a) FSK
 - b) BPSK
 - c) **MFSK**
 - d) MPSK
16. Processing gain is given as
- a) W_{ss}/R
 - b) R_{ch}/R
 - c) **W_{ss}/R & R_{ch}/R**
 - d) None of the mentioned
17. Uncertainty in the distance between transmitter and receiver translates into uncertainty in
- a) Frequency
 - b) Propagation delay
 - c) **Efficiency**
 - d) None of the mentioned
18. DSSSS stand for
- a) **Direct Sequence Spread Spectrum**
 - b) Direct Sequence Signal System



- c) Direction Sequence Signal and System
d) either (a) or (b)
19. Pseudorandom signal _____ predicted.
a) **Can be** c) maybe
b) Cannot be d) None of the mentioned
20. The properties used for pseudorandom sequence are
a) Balance c) Correlation
b) Run **d) All of the mentioned**
21. DS/BPSK includes
a) Despreading **c) Despreading & Demodulation**
b) Demodulation d) None of the mentioned
22. In direct sequence process which step is performed first?
a) **De-spreading** c) Despreading & Demodulation
b) Demodulation d) None of the mentioned
23. Chip is defined as
a) **Shortest uninterrupted waveform** c) Shortest diversion
b) Largest uninterrupted waveform d) None of the mentioned
24. Which modulation scheme is preferred for direct sequence spread spectrum process?
a) BPSK **c) BPSK & QPSK**
b) QPSK d) None of the mentioned
25. The frequency hopping system uses _____ modulation scheme.
a) FSK **c) MFSK**
b) BPSK d) MPSK
26. Which system allows larger processing gain?
a) Direct sequence
b) **Frequency hopping**
c) Direct sequence & Frequency hopping
d) None of the mentioned
27. Which type of demodulator is used in the frequency hopping technique?
a) Coherent c) Coherent & Non coherent
b) **Non coherent** d) None of the mentioned
28. Chips are the
a) **Repeated symbols** c) Smallest length symbols
b) Non repeated symbols d) None of the mentioned
29. Slow frequency hopping is
a) Several hops per modulation c) Several symbols per modulation
b) **Several modulations per hop** d) None of the mentioned
30. Fast frequency hopping is
a) Several modulations per hop c) Several symbols per modulation
b) Several modulations per symbol **d) None of the mentioned**
31. Which duration is shorter?
a) **Hop duration** c) Chip duration
b) Symbol duration d) None