SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF

ELECTRONICS AND COMMUNICATION ENGINEERING

QUESTION BANK

I SEMESTER

1911102 – ADVANCED DIGITAL COMMUNICATION TECHNIQUES

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DEPARTMENT OF ECE

QUESTION BANK

SUBJECT : ADVANCED DIGITAL COMMUNICATION TECHNIQUES

SEM / YEAR: M.E-Communication Systems/Sem-I

UNIT I COHERENT AND NON-COHERENT COMMUNICATION			
Coherent receivers , Optimum receivers in WGN , IQ modulation & demodulation ,Non coherent receivers in random phase channels; MFSK receivers , Rayleigh and Rician channels ,Partially coherent receivers , DPSK; M-PSK; M-DPSK—BER Performance Analysis. Carrier Synchronization			
PART A(2 Marks)			
Q. No	Questions	BT Level	Competence
1.	What is a coherent receiver? Mention its properties	BTL 1	Remembering
2.	Define BER. What is its significance?	BTL 1	Remembering
3.	Draw the block schematic of digital communication over AWGN channel.	BTL 3	Applying
4.	How is Rayleigh fading characterized?	BTL 1	Remembering
5.	Write the error probability for both coherent and non coherent signaling.	BTL 1	Remembering
6.	Compare MFSK and DPSK.	BTL 4	Analyzing
7.	Demonstrate the properties of Rician channel.	BTL 3	Applying
8.	Distinguish between coherent and non coherent communications?	BTL 4	Analyzing
9.	Evaluate the properties of Rayleigh channel.	BTL 5	Evaluating
10.	What is meant by coherent and noncoherent Detection?	BTL 1	Remembering
11.	Illustrate Rician Channel	BTL 2	Understanding
12.	State the need for WGN.	BTL 1	Remembering
13.	Justify the merits and demerits of coherent receivers	BTL 5	Evaluating

14.	Design a matched filter?	BTL 6	Creating
15.	Model the non-coherent receiver for equal energy signals using envelope detector.	BTL 3	Applying
16.	Analyze the significance of optimum M-FSK receivers?	BTL 4	Analyzing
17.	Summarize M-ary waveform receiver?	BTL 2	Understanding
18.	Compute the error probability for both coherent and non coherent signaling.	BTL 2	Understanding
19.	Construct carrier synchronization	BTL 6	Creating
20.	Draw IQ modulator and Demodulator.	BTL 2	Understanding
	PART – B (13 Marks)		
1.	(i)Describe the characteristics of Rayleigh and Rician channel in detail. (7) (ii)Give an account on "Bit synchroniztion" (6)	BTL 1	Remembering
2.	(i)Prove the properties of optimum receivers in WGN. (6) (ii)Define and explain 1.PRBS pattern 2.ISI 3.Eye diagram (7)	BTL 5	Evaluating
3.	Explain the principle of IQ modulation and demodulation. (6) Summarize the characteristics of rician channels. (7)	BTL 2	Understanding
4.	Breifly describe the carrier synchronization and bit synchronization techniques. (13)	BTL 1	Remembering
5.	(i)Write the principle of optimum receiver used in WGN. (7) (ii)Outline the characteristics of Rayleigh channel. (6)	BTL 1	Remembering
6.	(i)Point out the probability of error for DPSK signaling scheme. (7) (ii)Analyze anyone of the carrier synchronization techniques. (6)	BTL 4	Analyzing
7.	(i)Develop the modeling framework for phase noise and I-Q imbalances in communication receivers. (7) (ii)With schematic diagram assess the carrier recovery for MPSK system and limiting recovery for an unmodulated carrier. (6)	BTL 6	Creating
8.	With the help of circuit schematic constellation diagram explain the principle of operation of M-ary Quadrature Amplitude modulation system. Also derive the BER. (13)	BTL 3	Applying
9.	(i)Draw the block diagram for partially coherent receivers and discuss its limitations. (7) (ii)Explain the non coherent detection of binary signals with neat block diagram. (6)	BTL 3	Applying
10.	Explain M-ary PSK modulation scheme with its basis functions and obtain an expression for the union bounded probability of error. (13)	BTL 2	Understanding

11.	(i)With a neat block diagram explain the function of DPSK and MPSK demodulators. (7) (ii)Describe the function of M - FSK receiver. (6)	BTL 2	Understanding
12.	Classify the types of M - FSK receiver with suitable diagram. (13)	BTL 4	Analyzing
13.	Analyze the performance of M-DPSK receiver with a suitable diagram. (13)	BTL 4	Analyzing
14.	Demonstrate the characteristics of suboptimum MFSK receiver. (13)	BTL 2	Understanding

PART C (15 Marks)			
Q. No	Questions	BT Level	Competence
1.	Evaluate the BER performance of DPSK, M-PSK and M-DPSK(15)	BTL 5	Evaluating
2.	Discuss in detail the various implementations of the matched filter. (15)	BTL 6	Creating
3.	Estimate the probability of error for DPSK signaling scheme (15)	BTL 6	Creating
4.	Compare and contrast the characteristics of Rayleigh and Rician channel. (15)	BTL 5	Evaluating

UNIT II EQUALIZATION TECHNIQUES			
Band Limited Channels- ISI – Nyquist Criterion- Controlled ISI-Partial Response signals- Equalization algorithms – Viterbi Algorithm – Linear equalizer – Decision feedback equalization – Adaptive Equalization algorithms. Comparision of equalization techniques.			
PART A(2 Marks)			
Q. No	Questions	BT Level	Competence
1.	What is the significance of eye pattern in communication channels	BTL 1	Remembering
2.	Write the features and applications of Viterbi algorithm.	BTL 1	Remembering
3.	State the principle and features of Zero forcing Equalizer	BTL 1	Remembering
4.	Observe the ways to mitigate the detrimental effect of ISI	BTL 2	Understanding
5.	Illustate the significance of Viterbi algorithm.	BTL 2	Understanding

6.	What is ZFE? Enumerate its features.	BTL 1	Remembering
7.	Define nyquist criterion. What does it signify?	BTL 1	Remembering
8.	Distinguish between linear and nonlinear equalizers.	BTL 4	Analyzing
9.	Demonstrate Nyquist criterion for band limited channels.	BTL 3	Applying
10.	Examine the causes for ISI.	BTL 4	Analyzing
11.	List out the characteristics of bandlimited channels.	BTL 1	Remembering
12.	Evaluate the application of eye pattern.	BTL 5	Evaluating
13.	Compute correlative coding?	BTL 3	Applying
14.	Discuss the causes for ISI?	BTL 6	Creating
15.	Summarize the applications of matched filter.	BTL 2	Understanding
16.	Give the concept of spread spectrum communication.	BTL 2	Understanding
17.	Categorize the types of equalizer.	BTL 4	Analyzing
18.	Construct the methods used to suppress the ISI?	BTL 3	Applying
19.	Design the model for eye pattern?	BTL 6	Creating
20.	Mathematically express the Nyquist Criterion in frequency domain for pulse shaping to realize ISI free transmission.	BTL 5	Evaluating
	PART – B (13 Marks)		
1.	(i)State and Explain Nyquist criterion .Derive the equation for Nyquist criterion. (7) (ii)Enumerate and explain the features of all equalization algorithms,with examples. (6)	BTL 1	Remembering
2.	(i)Differentiate Decision feedback equalizer from zero forcing equalizer. Explain the differences. (7) (ii)Draw a neat schematic of an Adaptive equalizer and explain its principle in detail. Bring out its design details. (6)	BTL 4	Analyzing
3.	What is meant by nyquist criterion?Eplain the equalization algorithms with suitable example. (13)	BTL 1	Remembering
4.	Write brief notes on (i) Linear equalizer. (7) (ii) Decision feedback equalization (6)	BTL 1	Remembering

5.	(i)Derive the minimum mean squared error for zero forcing Decision feedback equalizer. (8) (ii)Illustrate the parameters of eye diagram. Explain the need for eye pattern in detail. (5)	BTL 2	Understanding
6.	(i)What is a transversal equalizer? Explain how it can be implemented? (7) (ii)Explain the concept of LMS equalizer with a neat diagram. Mention its applications. (6)	BTL 4	Understanding
7.	(i)Explain the principle and working of predictive decision feedback equalizer. (7) (ii)Explain Mean Square Error Criterion of an equalizer. (6)	BTL 2	Understanding
8.	(i)Evaluate the performance characteristics of the MSE equalizer. (7) (ii)Summarize the concept of coefficient optimization with respect to decision feedback equalizer. (6)	BTL 5	Evaluating
9.	(i)Apply MMSE concepts to derive the transfer function of a MMSE equalizer for a band limited channel. (7) (ii)Derive the decision rule for optimum demodulation of digital signal in the presence of IS I and AWGN. (6)	BTL 3	Applying
10.	(i)Write a note on various techniques used for minimizing ISI. (8) (ii)Write short note on Viterbi algorithm. (5)	BTL 1	Remembering
11.	(i)Analyze the duobinary signaling scheme without and with precoder for controlled ISI (7) (ii)Classify the types of method to suppress ISI. (6)	BTL 4	Analyzing
12.	Calculate the transfer function and impulse response of duobinary systems which is used to control the ISI with appropriate diagram.(13)	BTL 3	Applying
13.	(i)Explain the need for equalization. Explain different types of equalization techniques. (8) (ii)Compare the equalization techniques. (5)	BTL 4	Analyzing
14.	(i)Design and formulate the parameters of eye diagram. Mention its usage in digital communication systems. (8) (ii)How it is used to know the information about a channel. (5)	BTL 6	Creating

PART C (15 Marks)			
Q. No	Questions	BT Level	Competence
1.	The binary data 001101001 are applied to the input of duobinary system. Find the received output under the case without precoder and with precoder. Suppose the bit at second place is decoded	BTL 6	Creating

	erroneously construct the receiver output for the two cases. (15)		
2.	Evaluate the performance and error probability of Viterbi algorithm and Turbo coding. (15)	BTL 5	Evaluating
3.	Enumerate and explain the features of all equalization algorithms, with examples. (15)	BTL 6	Creating
4.	Compare and contrast DFE and ZFE. (15)	BTL 5	Evaluating

UNIT III BLOCK CODED DIGITAL COMMUNICATION

Architecture and performance – Binary block codes; Orthogonal; Biorthogonal;Transorthogonal – Shannon's channel coding theorem; Channel capacity; Matched filter;Concepts of Spread spectrum communication, Applications of Spread spectrum communication – Coded BPSK and DPSK demodulators–Linear block codes; Hammning; Golay; Cyclic; BCH ; Reed – Solomon codes – Spacetime block codes.

PART A (2 Marks)

Q. No	Questions	BT Level	Competence
1.	Define Constellation Diagram.	BTL 1	Remembering
2.	What is a syndrome Calculator? Mention its applications.	BTL 1	Remembering
3.	What are space time block codes?	BTL 1	Remembering
4.	State Shannon's Channel coding Theorem.	BTL 1	Remembering
5.	List out the applications of matched filter	BTL 1	Remembering
6.	Give the concept of spread spectrum communication.	BTL 2	Understanding
7.	Calculate the capacity of AWGN channel with bandwidth 200 Khz and SNR of 15 dB.	BTL 3	Applying
8.	For the data unit of 12 bit size,find the minimum number of redundancy bits needed to correct 1 single bit error.	BTL 3	Applying
9.	Analyze the advantages and applications of Hamming codes?	BTL 4	Analyzing
10.	How is a syndrome array constructed?	BTL 1	Remembering
11.	Illustrate Shannon's channel capacity theorem	BTL 2	Understanding
12.	Relate Golay code with extended Golay code?	BTL 2	Understanding
13.	Observe the parameters affecting the performance of block coded communication system?	BTL 2	Understanding
14.	Draw the waveform representation of antipodal and orthogonal signals.	BTL 3	Applying

15.	Write the significance of trans-orthogonal code.	BTL 3	Remembering
16.	Evaluate the relation between LBC and cyclic code?	BTL 5	Evaluating
17.	When a (n,k) linear block code is called Hamming code?If the minimum hamming distance of a (n,k) linear block code is 3, then what is its minimum Hamming weight. And find out the hamming weight of the codes 101010 and 010101.	BTL 3	Applying
18.	What is RS code? For a 8 bit RS codes, determine the block length n.	BTL 5	Evaluating
19.	Formulate the error detection and error correction capability of Hamming code.	BTL 6	Creating
20.	Construct the infinite bandwidth Shannon Information transport limit.	BTL 6	Creating
	PART – B (13 Marks)		
1.	Explain in detail about the properties of binary block codes (13)	BTL 1	Remembering
2.	(i)The generator matrix of (6,3) systematic block code is given by, G = {{1,0,0,0,1,1}},{0,1,0,1,0,1},{0,0,1,1,1,1}} (ii)Find code vectors, the parity check matrix and error syndrome. (13)	BTL 5	Evaluating
3.	(i)State the properties of binary cyclic codes.Derive the polynomial representation of its code vector. (8) (ii)Write a technical note on "Reed- Solomon codes". (5)	BTL 1	Remembering
4.	Describe architecture and performance of binary block codes and digital communication with suitable example. (13)	BTL 1	Remembering
5.	(i)Illustrate the concept of spread spectrum communication. (8) (ii)Summarize the algebraic structure of cyclic codes. (5)	BTL 2	Understanding
6.	(i)Explain the architecture and performance of binary block codes. (7) (ii)With a suitable example discuss the generation and applications of Hamming code. (6)	BTL 2	Understanding
7.	(i)Draw the block diagram for DPSK demodulator, explain its working and point out the limitations of it. (7) (ii)Describe the role of Reed Solomon code in digital communication. (6)	BTL 2	Understanding
8.	The polynomial of a 2 ary PN sequence generator $f(x) = x^3+x+1$.Draw the PN sequence generator and Calculate the set of PN sequences. (7) A generator polynomial for (7,4) cyclic code is given by $g(p)=p^3+p+1$.obtain the systematic code for the message 1011. (6)	BTL 3	Applying
9.	Consider a (7,4) block code with generator matrix given by $G=\begin{bmatrix}1&0&0&0&1&0&1\\0&1&0&0&1&1&1\\0&0&1&0&1&1&0\\0&0&0&1&0&1&1\end{bmatrix}$ Obtain : (1) The codeword for the message 1 0 1 1	BTL 3	Applying

	(2) The parity check matrix (3) Syndrome table and prove the error correction capability of the code. (8) (4) State the properties of Reed –solomon code. (5)		
10.	(i)Design a linear block code with a minimum distance of 3 and a message block size of 8 bits. (7) (ii)Construct the algebraic structure of cyclic codes. (6)	BTL 6	Creating
11.	(i)Classify the types of spread spectrum communication in detail. (8) (ii)Differentiate cyclic codes from convolutional codes. (5)	BTL 4	Analyzing
12.	(i)What is a matched filter? Explain the different properties of it. (7) (ii)Explain in detail about the types of linear block codes. (6)	BTL 1	Remembering
13.	(i)With a neat diagram, explain Reed-solomon encoding and decoding circuit. (7) (ii)Analyze the advantages disadvantages and application of the code.(6)	BTL 4	Analyzing
14.	Examine the architecture and performance of biorthogonal and transorthogonal codes in digital communication system. (13)	BTL 4	Analyzing

PART C(15 Marks)

Q. No	Questions	BT Level	Competence
1.	For a (6, 3) code, generator matrix G is 100101; 010011; 001110. For all possible data words, find the corresponding code words and verify that the code is single error correcting code. Determine the syndrome vector for the error pattern 000100.	BTL 6	Creating
2.	(i)Derive the expression for relating the matched filter theory to the channel capacity . (ii) The parity check bits of a (8,4) block code are generated by, C5 = d1+ d2+ d4 , C6 = d1+ d2+ d3, C7 = d1+ d3+ d4 and C8 = d2+ d3+ d4 where d1, d2, d3 and d4 are message bits. 1. Find the G and P matrix for this code. 2. List all code vectors. 3. Find all errors detecting and correcting capabilities of this code. 4. Show that this code detects up to 3 errors only with suitable example.	BTL 6	Creating
3.	Compare and contrast the error probability performance of coded BPSK and DPSK demodulators.	BTL 5	Evaluating
4.	Evaluate the error probability performance for BPSK and Viterbi Algorithm.	BTL 5	Evaluating

UNITIV CONVOLUTIONAL CODED DIGITAL COMMUNICATION

Representation of codes using Polynomial, State diagram, Tree diagram, and Trellisdiagram – Decoding techniques using Maximum likelihood, Viterbi algorithm, Sequentialand Threshold methods – Error probability performance for BPSK and Viterbi algorithm,Turbo Coding.

PART A (2 Marks)			
Q. No	Questions	BT Level	Competence
1.	What are the practical applications using turbo codes?	BTL 1	Remembering
2.	State maximum likelihood decoding.	BTL 1	Remembering
3.	Write the advantages of turbo coding.	BTL 1	Remembering
4.	Illustrate constraint length and free distance for convolutional code?	BTL 2	Understanding
5.	Classify the types of decoder for convolutional codes? Which technique is most popular?	BTL 4	Analyzing
6.	What is the concept of turbocoding?	BTL 1	Remembering
7.	In m-ary signaling, express the union upper bound on conditional probability of error.	BTL 2	Understanding
8.	When does a MAP detector become ML detector?	BTL 4	Remembering
9.	Define BER and draw an illustrative plot that shows the improvement in BER on using error control codes.	BTL 2	Understanding
10.	Which technique of decoding is most popular in convolutional codes?Why?	BTL 5	Evaluating
11.	Define convolutional code?	BTL 1	Remembering
12.	Summarize the disadvantages of convolutional codes.	BTL 2	Understanding
13.	Evaluate the features of Trellis code.	BTL 5	Evaluating
14.	Identify the applications of turbo coding.	BTL 3	Applying
15.	Differentiate LBC and Convolutional codes.	BTL 4	Analyzing
16.	Draw the convolutional encoder for x1 = m + m1 + m2 and x2 = m + m2.	BTL 3	Applying
17.	Construct coding gain.	BTL 3	Applying
18.	Generate the code rate of (n,k) convolutional code?	BTL 6	Creating
19.	Examine the decoding techniques using maximum likelihood	BTL 4	Analyzing
20.	Formulate the rule for Maximum likelihood decoding.	BTL 6	Creating
PART – B (13 Marks)			

1.	With an example describe the following: (i) State diagram (5) (ii) Tree diagram (4) (iii) Trellis diagram. (4)	BTL 1	Remembering
2.	Write short notes on the following: (i) Decoding technique using maximum likelihood. (8) (ii) Turbo coding. (5)	BTL 1	Remembering
3.	Derive the maximum likelihood decoding procedure using viterbi algorithm for coded BPSK modulation scheme. (13)	BTL 3	Applying
4.	For the given convolutional encoder determine (i) Dimension of the code, (ii) Code rate, iii) Constraint length (iv)Generating sequence and (v) Code the input message sequence m={ 1 1 0 1 1 1 0} (13)	BTL 3	Applying
5.	Explain the error probability performance for BPSK , Viterbi algorithm and turbo coding. (13)	BTL 1	Remembering
6.	A convolutional encoder has single shift register with two stages three modulo – 2 adders and an output multiplexer. The following generator sequences are combined by the multiplexer to produce the encoder output.g1 = (1, 0, 1) , g2= (1 1 0) and g3 = (1 1 i) Draw the block diagram of the encoder (ii)For the message sequence(1 0 0 1 1) Determine encoded sequence. (13)	BTL 2	Understanding
7.	(i)Mention the difference between tree and trellis diagram. (5) (ii)A convolutional encoder has a single shift register with two stages (K=3), three modulo 2 adders and an output multiplexer. The generator sequences of the encoder are as follows. g1 = (1, 0, 1) , g2= (1 1 0) and g3 = (1 1 1). Draw the block diagram and explain. (8)	BTL 4	Analyzing
8.	A convolutional code is described by the following generator sequence g1 = (1, 0, 0) , g2= (1 1 0) and g3 = (1 1 1). i. Draw the encoder diagram for this code. ii. Draw the state and trellis diagram for this code. iii. iii. Find the code word corresponding to the message sequence(1010101) (13)	BTL 2	Understanding
9.	Design the encoder structure of a parallel concatenated convolutional codes and explain it in detail (13)	BTL 6	Creating
10.	Explain in detail Trellis diagram with an example. (13)	BTL 2	Understanding
11.	Explain the concept of convolutional codes using polynomial, state diagram and trellis diagram. (13)	BTL 1	Remembering
12.	(i)Compute the expression for error probability performance of BPSK. (8) (ii)Explain Viterbi decoding algorithm for convolutional code. (5)	BTL 3	Applying

13.	(i)Differentiate cyclic codes from convolutional codes. (5) (ii)Draw a rate ½ convolutional encoder and draw its Trellis diagram representation. Explain them in detail. (8)	BTL 4	Analyzing
14.	(i)Explain : 1. Turbo coding 2. Viterbi algorithm in detail. (7) (ii)Consider a rate ½, constraint length 6 convolutional code with free distance as 9.Calculate the asymptotic coding gain for binary input AWGN channel. (6)	BTL 5	Evaluating
PART C(15 Marks)			
Q. No	Questions	BT Level	Competence
1.	For a (6, 3) code, generator matrix G is 100101; 010011; 001110. For all possible data words, Find the corresponding code words and verify that the code is single error correcting code. Evaluate the syndrome vector for the error pattern 000100. (15)	BTL 5	Evaluating
2.	(i)Derive the expression for relating the matched filter theory to the channel capacity. (5) (ii)The parity check bits of a (8, 4) block code are generated by, C5 = d1+ d2+ d4, C6 = d1+ d2+ d3, C7 = d1+ d3+ d4 and C8 = d2+ d3+ d4 where d1, d2, d3 and d4 are message bits. 1. Find the G and P matrix for this code. 2. List all code vectors. 3. Find all errors detecting and correcting capabilities of this code. 4. Show that this code detects up to 3 errors only with suitable example. (10)	BTL 6	Creating
3.	Given the ½ rate convolutional encoder defined by P1(x) = 1+x+x2 and P2(x)=1+x, and assuming data is fed into a shift register one bit at a time, draw the encoder (a) Tree diagram (b) Trellis diagram (c) state transition diagram and use Viterbi decoding algorithm to decode to decode the received block of data,10011000. (15)	BTL 6	Creating
4.	Compare the different threshold based decoding methods. (15)	BTL 5	Evaluating

UNIT V MULTICARRIER AND MULTIUSER COMMUNICATIONS
Single Vs multicarrier modulation, orthogonal frequency division multiplexing (OFDM), Modulation and demodulation in an OFDM system, An FFT algorithmic implementation of an OFDM system, Bit and power allocation in multicarrier modulation, Peak-to-average ratio in multicarrier modulation. Introduction to CDMA systems, multiuser detection in CDMA systems – optimum multiuser receiver, suboptimum detectors
PART A (2 Marks)

Q. No	Questions	BT Level	Competence
1.	Write the concept of OFDM signal processing?	BTL 1	Remembering
2.	What is meant by modulation and demodulation in an OFDM system?	BTL 1	Remembering
3.	State single carriermodulation in OFDM.	BTL 1	Remembering
4.	Define the term FFT?	BTL 1	Remembering
5.	What are the advantages and disadvantages of OFDM?	BTL 1	Remembering
6.	Spell the concept of CDMA.	BTL 1	Remembering
7.	Illustrate the bit and power allocation in multicarrier modulation.	BTL 2	Understanding
8.	Examine the need of multiuser detection in CDMA systems.	BTL 4	Analyzing
9.	Analyze how the modulation and demodulation is done in OFDM	BTL 4	Analyzing
10.	Apply the concept of filtering in OFDM.	BTL 3	Applying
11.	Summarize CDMA system in multiuser communications.	BTL 2	Understanding
12.	Give the main idea of PAP?	BTL 2	Understanding
13.	Assess the significance of Orthogonal frequency division multiplexing?	BTL 5	Evaluating
14.	Analyze the difference between optimum and suboptimum multiuser detections.	BTL 4	Analyzing
15.	Develop the peak to average power ratio for OFDM signals.	BTL 6	Creating
16.	Illustrate the disadvantages of multicarrier OFDM modulation system.	BTL 3	Applying
17.	What is the purpose of successive interference cancellation?	BTL 3	Applying
18.	Formulate the need for implementation of FFT algorithm in OFDM system?	BTL 6	Creating
19.	Evaluate the performance of suboptimum detectors in CDMA systems?	BTL 5	Evaluating
20.	Give the concept of multicarrier transmission technique?	BTL 2	Understanding
PART – B(13 Marks)			
1.	Illustrate how OFDM concept is emerged in multicarrier modulation	BTL 3	Applying

	technique. (13)		
2.	Develop the concept of multicarrier modulation techniques in OFDM with suitable diagrams. (13)	BTL 6	Creating
3.	How to implement FFT algorithm in an OFDM system and explain in detail. (13)	BTL 1	Remembering
4.	(i) Explain about the parameters required for OFDM system design.(7) (ii) Draw the block diagram of OFDM transmitter and receiver. Explain them in detail. (6)	BTL 2	Understanding
5.	Discuss PAP reduction schemes with a neat diagram and explain its application. (13)	BTL 4	Analyzing
6.	Explain in detail of any two methods to reduce peak-to-average power ratio in multicarrier OFDM system. (13)	BTL 2	Understanding
7.	Discuss the generation of subcarriers using the IFFT with a neat diagram. (13)	BTL 4	Analyzing
8.	Write about the single and multicarrier modulation in OFDM. (13)	BTL 1	Remembering
9.	Elaborate about modulation and demodulation in an OFDM systems. (13)	BTL 3	Appling
10.	Draw the block diagram of a multicarrier OFDM digital communication. (13)	BTL 2	Understanding
11.	Write short note on i) Optimum Multiuser receiver (6) ii) Suboptimum Detection. (7)	BTL 1	Remembering
12.	Evaluate the performance of bit and power allocation in multicarrier modulation (13)	BTL 5	Evaluating
13.	Define and explain OFDM signal processing (13)	BTL 1	Remembering
14.	Discuss in detail about peak power problem in OFDM. (13)	BTL 4	Analyzing

PART C (15 Marks)			
Q. No	Questions	BT Level	Competence
1,	Compare the performance of Single and multicarrier modulation in OFDM. (15)	BTL 5	Evaluating
2.	Formulate the process of bit and power allocation in multicarrier modulation. (15)	BTL 6	Creating
3.	Discuss in detail about optimum and suboptimum detectors in CDMA systems (15)	BTL 6	Creating

4.	Evaluate the key features, merits and demerits of modulation and demodulation in an OFDM system. (15)	BTL 5	Evaluating