

THE KAVERY ENGINEERING COLLEGE
(An Autonomous Institution)

**B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, APRIL-MAY
2025**

Fifth Semester

Biomedical Engineering

CBM354 -

Communication Systems

Regulations - 2021

Duration : 3 Hrs

Maximum : 100 Marks

PART – A (ANSWER ALL QUESTIONS) (Marks 10*2=20)

Q.No	Questions	BLT	CO	Marks
1.	What is Vestigial Sideband (VSB) modulation, and in what applications is it commonly used?	L1	1	2
2.	Differentiate between Phase Modulation (PM) and Frequency Modulation (FM).	L2	1	2
3.	State the relation between noise temperature and noise figure.	L3	2	2
4.	State the advantages and disadvantages of single tuned receivers in terms of noise performance.	L2	2	2
5.	Write down the formula for mutual information and mention its properties.	L1	3	2
6.	What is the channel capacity of binary symmetric with error probability of 0.2?	L2	3	2
7.	What is Differential Phase Shift Keying (DPSK), and how does it improve upon standard PSK?	L2	4	2
8.	How does the geometric representation help in visualizing modulation schemes?	L3	4	2
9.	What is the Viterbi algorithm, and how is it used in decoding convolutional codes?	L2	5	2
10.	State the properties of cyclic codes.	L3	5	2

PART – B (ANSWER ALL QUESTIONS) (Marks 5*16 = 80)

Q.No	Questions	BLT	CO	Marks
11.	a Derive the expression for an Amplitude Modulated wave and draw its spectrum. Obtain a relationship between carrier and sideband powers in an AM DSBFC wave and explain how power distribution takes place in AM DSBFC system.	L2	1	16
	Or			
	b i Derive mathematical expression for FM wave.	L2	1	8
	ii A 25MHz carrier is modulated by a 400 Hz audio sine wave. If the carrier voltage is 4V and the maximum frequency deviation is 10KHz and phase deviation is 25 radians. Write the equation of this modulated wave for i) FM ii) PM. If the modulating frequency is now changed to 2KHz, all else remaining	L2	1	8

constant. Write a new equation for FM and PM.

- | | | | | | |
|-----|-----|---|----|---|----|
| 12. | a | Explain the operation of a super heterodyne receiver. How does it convert high-frequency signals to lower intermediate frequencies for easier processing? | L2 | 2 | 16 |
| | | Or | | | |
| | b | Describe a practical application in which a cascaded receiver system is used. What design considerations are necessary to minimize noise? | L3 | 2 | 16 |
| 13. | a i | For a discrete memory less source 'X' with six symbols $x_1, x_2, x_3, \dots, x_6$ find a compact code for every symbol if the probability distribution is as follows: $P(x_1)=0.3$, $p(x_2)=0.25$, $p(x_3)=0.2$, $p(x_4)=0.12$, $p(x_5)=0.08$, $p(x_6)=0.05$. calculate the entropy of the source average length of the code, efficiency and redundancy of the code. | L2 | 3 | 8 |
| | ii | State and explain Shannon's theorem on channel capacity. | L2 | 3 | 8 |
| | | Or | | | |
| | b i | Five source messages are probable to appear as $m_1=0.4$, $m_2=0.19$, $m_3=0.16$, $m_4=0.15$ and $m_5=0.15$. Find coding efficiency for i) Shannon-fano coding ii) Huffman coding. | L2 | 3 | 10 |
| | ii | Derive an expression for capacity of a Binary Symmetric Channel. | L2 | 3 | 6 |
| 14. | a i | Summarize the performance of maximum likelihood detection against other detection strategies in terms of computational complexity and accuracy. | L3 | 4 | 8 |
| | ii | Outline the application of QAM in contemporary wireless communication technologies, such as Wi-Fi or 4G/5G. What advantages does it offer? | L3 | 4 | 8 |
| | | Or | | | |
| | b i | Summarize the factors that affect the bit error rate (BER) of coherent BPSK, BFSK, and QPSK. How do these factors impact system performance? | L3 | 4 | 8 |
| | ii | Demonstrate PSD for evaluating the performance of a communication system? Provide an example of its application in signal design. | L3 | 4 | 8 |
| 15. | a i | The generator polynomial of a (7,4) cyclic code is $G(p)=p^3+p+1$. Find all the code vectors for the code in systematic form and non-systematic form. | L3 | 5 | 8 |
| | ii | Compare and contrast cyclic codes from linear block codes. | L3 | 5 | 8 |
| | | Or | | | |

b Consider a convolutional encoder with the following parameters: L3 5 16

- Constraint length $K=3$
- Generator polynomial $G(D)=(1+D, 1+D+D^2)$
- a. Given the input bit sequence 1011, encode it using the convolutional encoder
- b. Show the encoded output bit sequence