Basavarajeswari Group of Institutions

BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institute under Visvesvaraya Technological University, Belagavi)

USN										Course Code	2	1	E	C	5	1

Fifth Semester B.E. Degree Examinations, September/October 2024

COMMUNICATION SYSTEMS - II

Duration: 3 hrs **Max. Marks: 100**

Note: 1. Answer any* FIVE *full questions choosing ONE full Question from each Module.
2. Missing data, if any, may be suitably assumed

Q. No		*Question*	*Marks*	*(RBTL:CO:PI)*
		Module-1		
1.	**a.**	What is digital modulation scheme? Explain block diagram of digital communication system.	**06**	(1 :1 : 1.2.2)
	b.	With a neat block diagram explain the generation and detection of BPSK.	**08**	(1 :1 : 1.2.1)
	c.	A binary FSK System transmits data at a rate of 10^6 bps over an AWGN channel. Noise PSD is 10^{-10} w/Hz. Find the average carrier power required to maintain an average probability of error $Pe \leq 10^{-4}$ for non-coherent binary FSK. Determine the channel B.W required.	**06**	(3 :1 : 1.2.1)
		(OR)		
2.	**a.**	Explain QPSK with suitable equations and signal space diagram. Also explain the generation of QPSK with block diagram.	**08**	(2:1 : 1.2.1)
	b.	A binary sequence 10010011 is transmitted over a communication channel using DPSK transmitter. Sketch the transmitted DPSK waveform assuming an initial bit of 1.	**06**	(2:1 : 1.2.1)
	c.	Binary data is transmitted over AWGN channel using BPSK at a rate of 1 Mbps. It is desired to have average probability of error $p_e \leq 10^{-4}$. Noise PSD is $N_0/2=10^{-12}$ w/Hz. Determine the average carrier power required to receive input if the detector is of coherent type.	**06**	(3 :1 : 1.2.1)
		Module-2		
3.	**a.**	With the help of neat block diagram, explain the model of spread spectrum digital communication system.	**06**	(2:2 : 1.2.1)
	b.	Write a short note on generation of PN sequence and state its properties.	**08**	(2:2 : 1.2.1)
	c.	Explain the generation of direct sequence spread spectrum signal with the relevant waveforms and spectrums.	**06**	(2:2 : 1.2.1)
		(OR)		
4.	**a.**	Give the difference between slow and fast frequency hopping spread spectrum.	**06**	(2:2 : 2.2.1)
	b.	Explain the operation of optimum receivers using coherent detection.	**08**	(2:2 : 2.2.1)
	c.	Explain in detail frequency hopping spread spectrum with its types.	**06**	(2:2 : 2.2.1)
		Module-3		
5.	**a.**	Define (i) Self information, also justify the reason for using logarithmic function for measurement of self-information? (ii) Entropy (iii) Rate of source.	**06**	(2:3 : 2.2.1)

Note: (RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI– Performance Indicator)

b. A Memory less source emits five messages with probabilities {0.4, 0.25, 0.15, 0.12, 0.08}. Find the Shannon-Fano code and determine its efficiency. **06** (3:3 : 2.2.1)

c. Construct a binary code for the following source using Shannon's binary encoding procedure and find the code efficiency and redundancy. **08** (3:3 : 2.2.1)
S= {s_1 ,s_2 ,s_3 } and P= {0.5,0.3, 0.2}

(OR)

6. a. Find the self-information and entropy if a source emits one of the following four symbols A, B, C and D in a statistically independent sequence with probabilities P={ 1/2, 1/4, 1/8 and 1/8}. **06** (3:3 : 2.2.1)

b. Construct a binary code by applying Huffman coding procedure for the message symbols with respective probabilities. **08** (3:3 : 2.2.1)

A	B	C	D	E	F	G
1/3	1/27	1/3	1/9	1/9	1/27	1/27

Determine code efficiency and redundancy.

c. Prove that entropy of zero memory extension source is given by **06** (2:3 : 2.2.1)
$H(S^n) = nH(S)$.

Module-4

7. a. The parity equations of a (8,4) LBC are given by **10** (3:4 : 2.2.1)
$C_5=d_1+d_2+d_4$ $C_6=d_1+d_2+d_3$ $C_7= d_1+d_3+d_4$ $C_8=d_2+d_3+d_4$
Where d_1, d2, d3, d4 are data bits.
(i) Find generator [G] and parity check matrices [H].
(ii) Find all the possible code vectors.
(iii) Find the minimum Hamming Weight

b. Consider a (6,3) linear block code whose generator matrix is given by **10** (3:4 : 2.2.1)

$$\begin{bmatrix} 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 \end{bmatrix}$$

(i) Find the parity check matrix. (ii) Find the minimum distance of the code. (iii) Draw the encoder circuit.

(OR)

8. a. Define Channel coding and discuss the need for Error control coding. **05** (1:4 : 2.2.1)

b. In a (7,4) LBC ,the syndrome is given by **10** (3:4 : 2.2.3)
$S_1=r_1+r_2+r_3+r_5$; $S_2=r_1+r_2+r_4+r_6$;$S_3=r_1+r_3+r_4+r_7$
(i) Find the parity check matrix [H].
(ii) Find the code word for all input sequences.
(iii) What is the syndrome for the received data 1011011?

c. For a systematic (6, 3) LBC, the parity matrix is [P]= $\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 0 \end{bmatrix}$. **05** (3:4 : 2.2.1)

Find all the possible code vectors.

Note: (RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI– Performance Indicator)

Module-5

9.	**a.**	What are cyclic codes? Explain the properties of binary cyclic codes (BCC).	**06**	(2 :5: 2.2.2)
	b.	For the convolution encoder shown in Fig. Q9 (b), write tree, state and trellis diagram and find the output for the message [10111].	**08**	(3 :5: 2.2.2)

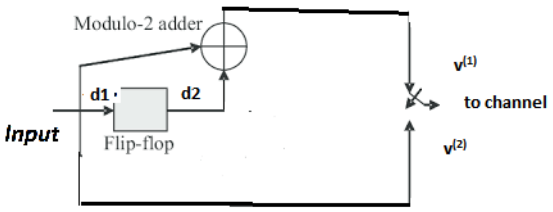

Fig. Q9(b)

	c.	Consider the (7, 4) cyclic code generated by $g(x)=1+X+X^3$. Find the code words for data D=1011 in a Systematic way.	**06**	(3 :5: 2.1.1)

(OR)

10	**a.**	Consider a (3,1,2) Convolution Encoder with $g^{(1)}$=(110), $g^{(2)}$=(101) and $g^{(3)}$=111. (i) Draw the encoder diagram (ii) Find the code word for the message sequence (11101) using Time domain approach and verify using Generator Matrix.	**10**	(3 :5: 2.2.3)
	b.	Consider a (15, 7) binary cyclic code with $g(x)=1+X^4+X^6+X^7+X^8$. (i) Draw the Encoder circuit. (ii) Obtain the code word for the input (0011100). (iii) Draw the Syndrome calculating circuit.	**10**	(3 :5: 2.2.3)

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