SCHEME OF COURSE WORK

Course Title	:Information Theory and Coding		
Course Code	: 13EC1123	L T P C	3 0 0 3
Program:	:B.Tech		
Specialization:	: Electronics and Communication Engineering		
Semester	:VI		
Prerequisites	: Probability Theory, Digital Communications		
Courses to which it is a prerequisite	: Satellite Communications		

Course Outcomes (Cos):

1	Illustrate the channel performance using Information theory.
2	Comprehend various error control code properties.
3	Describe linear block codes for error detection and correction
4	Comprehend convolution codes and cyclic codes for error detection and correction
5	Design BCH & RS codes for Channel performance improvement

Course Outcomes versus Program Outcomes:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M			M					S	S
CO2	S	S		S	M	M	M				S	S
CO3	S	S	S	S	S	M	M				M	S
CO4	S	S	S	M	S	M					M	S
CO5	S	S		S	M	M					S	S

S - Strongly correlated, M - Moderately correlated, Blank - No correlation

Assessment Methods:	Assignment / Quiz / Seminar / Case Study / Mid-Test / End Exam

Week	Topic /Contents	Course Outcomes	Sample questions	Teaching-Learning Strategy	Assessment Method & Schedule
1	Entropy, Information rate, Mutual Information	CO1	1. Explain the terms (i) Uncertainty (ii) Information (iii) Entropy 2. An analog signal is band limited as 8 KHz. It is quantized in 128 levels of PCM with equally likely probabilities. Find the information rate and Entropy.	Lecture/ Problem solving	Assignment I/Quiz-I/Mid-I
2	source coding: Shannon-Fano and Huffman coding techniques	CO1	1. Given xi = {x1, x2, x3, x4, x5, x6} with probabilities P(xi) = {0.3, 0.25, 0.2, 0.12, 0.08, 0.05}. Make Huffman code. Find efficiency of this code 2. A discrete source transmits six messages symbols with probabilities of 0.3, 0.2, 0.2, 0.15, 0.1, 0.05. Device suitable Fano and Huffman codes for the messages and determine the average length and efficiency of each code.	Lecture/ Problem solving	Assignment I/Quiz-I/Mid-I
3	Channel capacity of Discrete Channel, Shannon- Hartley law, Trade-off between bandwidth and SNR.	CO1	1. Give the relationship between channel capacity ‘C’ bandwidth ‘W’ and signal to noise ratio S/N of a AWGN channel. Explain the	Lecture/ Problem solving	Assignment I/Quiz-I/Mid-I

			tradeoff between them 2. Define mutual information. Explain how it is related to entropy for a lossless channel and prove that H(X/Y) = 0.		
4	CONTROL CODES: Examples of the use of error control codes, basic notions	CO2	1. Explain error control coding with the help of a suitable diagram 2. Write short notes on uses of Error Control Coding in Digital systems	Lecture/ Discussion	Assignment I/Quiz-I/Mid-I
5	Coding gain, Characterization of Error control codes performance of error control codes	CO2	1. Write a short note on interleaving coding 2. Write a short note on sequential coding.	Lecture/ Discussion	Assignment I/Quiz-I/Mid-I
6	Comparison of uncoded and coded systems.	CO2	1. Compare the coded and uncoded system	Lecture/ Discussion	Assignment I/Quiz-I/Mid-I
7	LINEAR BLOCK CODES: Linear block codes and their properties	CO3	1. Design a linear block code with minimum distance of 3 and a message block of length 8 bits. Obtain and draw the [G] and [H] matrix 2. List the properties of linear block codes	Lecture/ Problem solving	Assignment I/Quiz-I/Mid-I
8	Mid-Test-1	--	---------	------	----------
9	standard arrays, syndromes, weight distribution	CO3	1.Explain the importance of syndromes	Lecture/ Problem solving	Assignment I/Quiz-I/Mid-I
10	Error detection/correction properties , modified linear block codes	CO3	1. Explain Hadamard code with an example. 2. What are single parity check bit code and repeated codes	Lecture/ Problem Solving	Assignment I/Quiz-I/Mid-I

11	CONVOLUTION CODES: Convolution encoders, structural properties of convolution codes	CO4	1.Explain the structural properties of Convolution encoders	Lecture/ Problem Solving	Assignment II/Quiz-II/Mid-II
12	trellis diagrams, Viterbi algorithm, and performance analysis	CO4	1. State the Viterbi algorithm. Explain the steps involved in Viterbi algorithm. 2.Define and clearly explain the following (i) Generator matrix (ii) Systematic linear block codes (iii) Parity check matrix	Lecture/ Problem solving	Assignment II/Quiz-II/Mid-II
13	CYCLIC CODES: General theory, Shift Register Implementations, Shortened Cyclic codes, CRCs for Error Detection.	CO4	1. What are cyclic codes and briefly describe the different classes of cyclic codes. 2. Design a Systematic Cyclic Encoder for a (7, 3) code, with a generator polynomial $g(x) = x^4 + x^3 + x^2+1$ and find the code word for the data word 110.	Lecture/ Problem solving	Assignment II/Quiz-II/Mid-II
14	Convolution codes: Convolution encoders, structural properties of convolution codes, state diagram, code tree, trellis diagrams.	CO4	1. A rate 2/3 convolution code is described by g1= [1011], g2=[1101], g3=[1010], Draw the encoder, code tree. 2. For the convolution encoder with $g^{(1)}$ =(111) and $g^{(2)}$ =(101), (i) Draw the encoder block diagram (ii) Find generator matrix (iii) Find the codeword for input sequence (10011)	Lecture/ Problem solving	Assignment II/Quiz-II/Mid-II

			(iv) Draw the trellis structure for the above code.		
15	BCH AND RS CODES: Algebraic Description	CO5	1. Design the coder for the (31,16) BCH code, $t \leq 3$. Decode the received vector w(x) = 1 + x + x".	Lecture/ Problem solving	Assignment II/Quiz-II/Mid-II
16	Frequency Domain Description	CO5	1. Write a short note on frequency domain description of BCH codes	Lecture/ Discussion	Assignment II/Quiz-II/Mid-II
17	Decoding Algorithms for BCH and RS Codes	CO5	1. Explain the fundamental concepts of BCH and RS codes. 2. Write short notes on decoding algorithms for BCH codes	Lecture/ Problem solving	Assignment II/Quiz-II/Mid-II
18	Mid-Test 2	------	----------		
19/20	END EXAM	------	------		