

COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC401	INFORMATION THEORY & CODING	4-0-0-4	2016
Prerequisite: EC302 Digital Communication			
Course objectives: <ul style="list-style-type: none"> To introduce the concept of information To understand the limits of error free representation of information signals and the transmission of such signals over a noisy channel To design and analyze data compression techniques with varying efficiencies as per requirements To understand the concept of various theorems proposed by Shannon for efficient data compression and reliable transmission To give idea on different coding techniques for reliable data transmission To design an optimum decoder for various coding schemes used. 			
Syllabus: Concept of amount of information, Entropy, Source coding, Channel Capacity, Shannon's Limit, Rate Distortion Theory, Channel Coding, Linear Block Codes, Cyclic codes, Cryptography, Convolutional Codes, Viterbi Algorithm			
Expected outcome: The students will be able to <ol style="list-style-type: none"> Apply the knowledge of Shannon's source coding theorem and Channel coding theorem for designing an efficient and error free communication link. Analyze various coding schemes Design an optimum decoder for various coding schemes used. 			
Text Books: <ol style="list-style-type: none"> P S Sathya Narayana, Concepts of Information Theory & Coding, Dynaram Publications, 2005 Simon Haykin: Digital Communication Systems, Wiley India, 2013. 			
References: <ol style="list-style-type: none"> Bose, Information theory coding and cryptography, 3/e McGraw Hill Education India , 2016 D.E.R. Denning, Cryptography and Data Security, Addison Wesley, 1983. J S Chitode, Information Theory and Coding, Technical Publications, Pune, 2009 Kelbert & Suhov, Information theory and coding by examples, Cambridge University Press, 2013 Shu Lin & Daniel J. Costello. Jr., Error Control Coding : Fundamentals and Applications, 2/e, Prentice Hall Inc., Englewood Cliffs, NJ,2004 			
Course Plan			
Module	Course contents	Hours	End Sem. Exam Marks
I	Introduction to Information Theory. Concept of information, units, entropy, marginal, conditional and joint entropies, relation among entropies, mutual information, information rate. Source coding: Instantaneous codes, construction of instantaneous codes, Kraft's inequality, coding efficiency and redundancy	9	15%
II	Noiseless coding theorem , construction of basic source codes, Shannon – Fano Algorithm, Huffman coding, Channel capacity – redundancy and efficiency of a channel, binary	9	15%

	symmetric channel (BSC), Binary erasure channel (BEC) – capacity of band limited Gaussian channels		
FIRST INTERNAL EXAM			
III	Continuous Sources and Channels: Differential Entropy, Mutual information, Waveform channels, Gaussian channels, Shannon – Hartley theorem, bandwidth, SNR trade off, capacity of a channel of infinite bandwidth, Shannon's limit	9	15%
IV	Introduction to rings, fields, and Galois fields. Codes for error detection and correction – parity check coding – linear block codes – error detecting and correcting capabilities – generator and parity check matrices – Standard array and syndrome decoding	9	15%
SECOND INTERNAL EXAM			
V	Perfect codes, Hamming codes, encoding and decoding Cyclic codes, polynomial and matrix descriptions, generation of cyclic codes, decoding of cyclic codes BCH codes, Construction and decoding, Reed Solomon codes	9	20%
VI	Convolutional Codes – encoding – time and frequency domain approaches, State Tree & Trellis diagrams – transfer function and minimum free distance – Maximum likelihood decoding of convolutional codes – The Viterbi Algorithm. Sequential decoding.	9	20%
END SEMESTER EXAM			

Question Paper

The question paper shall consist of three parts. Part A covers modules I and II, Part B covers modules III and IV, and Part C covers modules V and VI. Each part has three questions uniformly covering the two modules and each question can have maximum four subdivisions. In each part, any two questions are to be answered. Mark patterns are as per the syllabus with 50% for theory and 50% for logical/numerical problems, derivation and proof.

