INFORMATION AND CODING THEORY

(Core Subject)

Course Code:	10M11EC213	**Semester:**	2nd Semester, M. Tech (ECE)
Credits:	3	**Contact Hours:**	L-3, T-0, P-0

Course Objectives

The objectives are to study

1. To bring both Circuits and System views on design together.
2. It offers a profound understanding of the design of complex digital VLSI circuits, computer aided simulation and synthesis tool for hardware design.

Course Outcomes

After studying this course the students would gain enough knowledge

1. Understand the static and dynamic behavior of MOSFETs (Metal Oxide Semiconductor Field Effect Transistors) and the secondary effects of the MOS transistor model.
2. To be aware about the trends in semiconductor technology, and how it impacts scaling and its effect on device density, speed and power consumption.
3. To understand MOS transistor as a switch and its capacitance.
4. Student will be able to design digital systems using MOS circuits (Static and Switching characteristics of inverters)
5. Able to learn Layout, Stick diagrams, Fabrication steps.
6. Understand the concept behind ASIC (Application Specific Integrated Circuits) design and the different implementation approaches used in industry.

Course Contents

Unit	**Topics**	**References (chapter number, page no. etc)**	**Lectures**
1.	Introduction to Information Theory, Uncertainty and information Theory, Average and mutual information, Entropy, information measures for continuous random variables, source coding theorem, Huffman coding, Shannon-Fano-Elias coding, Arithmetic Coding, Lempel-Ziv Algorithm, Run length encoding	Text Book 1: Chapter 1	6
2.	Channel capacity and Coding - Introduction, channel models, channel capacity, information capacity theorem, parallel Gaussian channels, Shannon limit, channel capacity for MIMO systems	Text Book 1 : Chapter 2	6
3	Error control coding (channel coding) - Linear	Text Book 1 : Chapter 3	10

	Block Codes for Error Correction: introduction, basic definitions, matrix description of linear block codes, equivalent codes, parity check matrix, decoding of linear block codes, syndrome decoding, error probability after coding, Hamming codes, Low Density Parity Check Codes, Optimal Linear Codes, Maximum distance separable codes, Space Time Block Codes.		
4	Cyclic Codes - Introduction, generation of cyclic codes, matrix description of cyclic codes fire codes, Golay codees, CRC codes.	Text Book 1 : Chapter 4	6
5	Bose-Chaudhuri Hocquenghem(BCH) codes - Introduction, Primitive elements, minimal polynomials, Reed-Solomom Codes	Text Book 1 : Chapter 5	6
6	Space-Time Codes - Introduction, Space-time code design criteria	Text Book 1: Chapter 6	4
7	Convolutional Codes - Introduction, Tree codes and Trellis codes, Matrix description, Viterbi decoding	Text Book 1: Chapter 6	4
		Total Number of Lectures	42

Evaluation Scheme

1. Test 1 :15 marks
2. Test 2 : 25 marks
3. Test 3 : 35 marks
4. **Internal Assessment** : 25 marks
    - 10 Marks : Class performance, Tutorials & Assignments
    - 10 Marks : Quizzes
    - 5 marks : Attendance

Text Books

1. Information Theory, Coding and Cryptography, Ranjan Bose, Third edition, TMH.
2. Information theory and Reliable communication, Robert G. Gallager, Wiley.