

<b>COURSE</b>	Name	: Information Theory and Coding
	Code	: EE185539
	Credit(s)	: 2
	Semester	: (Elective Course)

### Description of Course

Information Theory and Coding is an elective course that discusses the Entropy concept and maximum channel capacity, two coding concepts namely source coding and channel coding, and how the mechanism of adding and reducing message bit redundancy is appropriate for these two types of coding so that communication systems can be designed in digital that is efficient in terms of power and bandwidth requirements.

### Learning Outcomes

#### Knowledge

(P01) Mastering the concepts and principles of science in a comprehensive manner, and to develop procedures and strategies needed for the analysis and design of systems related to the field of power systems, control systems, multimedia telecommunications, electronics, intelligent multimedia network, or telematics as a preparation for further education or professional career.

#### Specific Skill

(KK01) Being able to formulate engineering problems with new ideas for the development of technology in power systems, control systems, multimedia telecommunications, electronics, intelligent multimedia network, or telematics.

(KK02) Being able to compose problem solving in engineering through depth and breadth of knowledge which adapts to changes in science and technology in power systems, control systems, multimedia telecommunications, electronics, intelligent multimedia network, or telematics.

#### General Skill

(KU11) Being able to implement information and communication technology in the context of execution of his/her work.

#### Attitude

(S09) Demonstrating attitude of responsibility on work in his/her field of expertise independently.

(S12) Working together to be able to make the most of his/her potential.

### Course Learning Outcomes

#### Knowledge

Mastering the concepts and theories of information and digital signal transmission channel capacity, mastering the concept of reducing redundancy on source coding for bandwidth savings and mastering the concept of adding redundant bits / parity checks on channel coding for power savings.

#### Specific Skill

Able to combine both the source coding and the channel coding concepts comprehensively in the engineering of digital communication systems so that problems in data transmission which include channel bandwidth limitations and limited power availability can be overcome.

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**General Skill**

Able to apply two types of coding, namely source coding and channel coding, and able to combine both comprehensively and implement them in software-based digital communication systems (MATLAB) so that they can be used to improve the performance of digital communication systems.

**Attitude**

Demonstrating attitude of responsibility for work in the field of digital signal / message transmission independently.

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**Main Subjects**

1. Information concepts and theories.
2. The concept of source coding in digital communication systems: Shannon-Fano code, Huffman code, and Lempel-Ziv code.
3. The concept of calculating communication channel capacity.
4. Algebraic concepts of coding: groups, fields and vector fields, Galois prime order fields and primitive polynomials.
5. The concept of channel coding: syndrome calculation, standard array and simple code coding: repetition code and Hamming code.
6. Channel coding concept: linear block code.
7. Channel coding concept: cyclic code.
8. Channel coding concept: convolutional code.
9. Concept of convolutional code decoding: Trellis diagram and Viterbi algorithm.
10. Simulation of source coding and channel coding using MATLAB.

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**Reference(s)**

- [1] K. Sam Shanmugan, Digital and Analog Communication Systems, 1st Edition,
- [2] Hwei Hsu, Ph.D., Schaum's outline of theory and problems of Analog and Digital Communications, 2nd Edition, Mc-Graw Hill, 2003.
- [3] John G. Proakis, Digital communications, 3rd Edition, Mc-Graw Hall, 1995.
- [4] Shu Lin and Daniel J Costello, Jr, "Error Control Coding Fundamentals and Application", Prentice-Hall Inc., 1983.
- [5] Stephen B Wicker, "Error Control Systems for Digital Communication and Storage,

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**Prerequisite(s)**

- Random Process and Statistical Signal Processing
  - Digital Communication Systems
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