Course Title	**Information Theory and Coding**
Course Code	**EE5321**
No. of Credit Hrs (Lecture + Tutorial + Lab)	**3 (2+0+1)**
No. of Contact Hrs (Lecture + Tutorial + Lab)	**4 (2+0+2)**
Level-Year	**9/10-5**
Prerequisite (if any)	**MATH3301, STAT1211**

1) Course Objectives:

To impart both theoretical and practical aspects of the information and Coding Theory. Students shall develop a mathematical understanding about information, channel capacity, and channel coding techniques. This course also give insight to channel and error-correction coding techniques.

2) Expected Learning Outcomes:

After completing this course, the students should be able to:

1. Describe and explain the fundamentals of information theory, source coding, channel models, channel capacity, and channel coding. PLO1 [1]
2. Identify and classify different types of block codes and convolutional codes. PLO1 [1]
3. Calculate and evaluate key parameters such as entropy, channel capacity, bit error rate, and code rate. PLO1 [1]
4. Investigate and perform laboratory experiments on essential techniques in information and coding theory. PLO3 [6]
5. Communicate and present applications of information and coding theory effectively through technical reports. PLO8 [3]
6. Engage in life-long learning by exploring modern coding methods and their applications in advanced communication systems. PLO9 [7]

3) Course Contents

1. Entropy, Mutual information, Source coding theorem, Data compression, Huffman coding, Asymptotic equipartition property
2. Gaussian channel, Discrete memoryless channels – BSC, BEC, Channel capacity, Shannon limit, Channel coding theorem
3. Differential entropy, Hamming weight, Hamming distance, Minimum distance decoding - Single parity codes, Hamming codes, Repetition codes
4. Linear block codes, Cyclic codes - Syndrome calculation, Encoder and decoder – CRC
5. Convolutional codes– code tree, trellis, state diagram - Encoding – Decoding: Sequential search and Viterbi algorithm
6. Principles of Turbo coding.

4) Lab Experiments

1. Write a program to determine the entropy and mutual information of a given channel.
2. Generation and evaluation of Huffman code.
3. Write program to compare the channel capacity of different types of channels.
4. Coding and decoding the data using Linear block codes.
5. Coding and decoding the data using convolutional codes.
6. Performance comparison of coded and uncoded communication system.
7. Write a program to implement the source coding and channel coding for transmitting a text file.

Use MATLAB/Octave/Scilab/Python/C++ or any other feasible programming software/language for the above experiments.

5) Teaching Methods:

- Lectures and Discussion
- Videos
- Self-learning
- Laboratory demonstrations

6) Mode of Evaluation: Course Assessment Methods

- Quizzes , Assignment, Homeworks, Reports, Presentations etc.
- Lab Work
- Mid Exam
- Final Exam

Evaluation

No	Assessment Activities *	Percentage
1.	Assignments/Quizzes/HomeWorks/Mini-Projects/Presentations/Reports+Quizzes	15%
2.	Mid Exam	25%
3.	Lab/Tutorial (Lab Exam)	10%
4.	Lab/Tutorial (Lab Reports)	10%
5.	Final Exam	40%

7) Textbook(s):

- Thomas M. Cover and Joy A. Thomas, " Elements of Information Theory", Wiley, 2006.
- Robert H. Morelos-Zaragoza, " The Art of Error Correcting Codes", John Wiley & Sons, 2006

8) References:

- Todd K. Moon, “Error Correction Coding” , Wiley Inter-Science, 2005