EE 521: Information and Coding Theory

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| **Lecture Schedule** | | See Time Table | | **Course Type, Semester** | | Spring 2019 | |
| **Credit Hours** | | Three | | **Pre-requisite** | | Stochastic Processes | |
| **Instructor** | | Ubaid Ullah Fayyaz, PhD | | **Contact** | | [ubaid@uet.edu.pk](mailto:ubaid@uet.edu.pk) | |
| **Office** | | Top Floor, EE Department. | | **Office Hours** | | TBA | |
| **Teaching Assistant** | | None | | **Lab Schedule** | | N/A | |
| **Website** | | <http://piazza.com/uet_lahore/spring2019/ee506> | | | | | |
| **Course Description** | | The course provides an introduction to the information theory, coding theory and how the two fields connect. The intended audience is the individuals involved in the development of digital communication systems both on hardware as well as algorithm level. The course will briefly explain how we calculate the limits to maximum data rate that can be achieved on a channel and will provide an overview of the some classic and modern codes used to approach these maximum rates. | | | | | |
| **Measurable Learning Outcomes** | **CLOs** | **Description** | | | **Domain/Level** | | **PLOs** |
| CLO1 | Apply mathematical tools needed to analyze information theoretic limits and channel codes to achieve them | | | Cognitive, 3 | | PLO1, Medium |
| CLO2 | Design an end-to-end error-correcting system using various classical and modern coding techniques. | | | Cognitive, 6 | | PLO3, Medium |
| CLO3 | Build a software simulation of an error-correcting system. | | | Psychomotor, 2 | | PLO5, Low |
|  | | **REQUIRED**:   1. Elements of Information Theory by Thomas M. Cover, Joy A. Thomas, 2nd Edition, Wiley (EOIT) 2. Error Control Coding by Shu Lin and Daniel J. Costello, 2nd Edition, Prentice Hall. (ECC)   **REFERENCE:**  1. Error Control Systems for Digital Communication and Storage by Stephen B. Wicker, Prentice Hall | | | | | |
| **Grading Policy vis-à-vis CLO Mapping** | | **Projects** | **30% - CLO1 to CLO3** | | | | |
| **Midterm** | **30% - CLO1, CLO3** | | | | |
| **Final** | **40% - CLO1 to CLO3** | | | | |

**Lecture Plan**

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| **Weeks** | Topics | **Readings & CLOs** |
| **2** | **Introduction to Information Theory**  Uncertainty, Information, Entropy, Discrete memoryless channel, Mutual Information, Channel Capacity | **Chapters 1,2 EOIT,**  **CLO1** |
| **2** | **Linear Block Codes**  Group Theory, Fields, Vector spaces, Hamming Codes, Syndrome decoder | **Notes,**  **CLO1, CLO3** |
| **2** | **Introduction to Cyclic Codes**  Polynomial representation  Generator polynomials for cyclic codes | **Notes,**  **CLO1-CLO3** |
| **1** | **BCH Codes**  Design and decoding algorithms | **Notes,**  **CLO1-CLO3** |
| **2** | **Convolutional Codes**  Design and decoding algorithms | **Notes,**  **CLO1-CLO3** |
| **1** | **Iterative Decoders** | **Notes,**  **CLO1-CLO3** |
| **2** | **Low-Density Parity-Check (LDPC) Codes**  Design and decoding algorithms | **Notes,**  **CLO1-CLO3** |
| **2** | **Polar Codes**  Design and decoding algorithms | **Notes,**  **CLO1-CLO3** |
| **2** | **Project Presentations** | **Notes,**  **CLO3** |