**Course Description Format**

**TITLE : Topics in Coding Theory**

**Course Code : ECE537**

**Note: Please use course code for previously existing course**

**CREDITS : 3-1-0-4**

**TYPE-WHEN : Spring 2021**

**FACULTY NAME : Prasad Krishnan**

**PRE-REQUISITE :** (Student should have **at least one of the below** prerequisites)

1. Necessity and meaning of Channel Coding (Error correcting codes), and encoding technique of least one of the codes discussed in syllabus should be *familiar* (studied few semesters back is OK) to student. (this course covers focusses on decoding mainly)
2. Alternatively, the student should be good with Communication Theory (AWGN channels, Digital Modulation schemes, Channel Coding Idea).

**OBJECTIVE :**

An introductory course in Coding theory typically focuses on the design of error correcting codes. This course will mainly focus on the decoding algorithms of codes that are extremely important in theory and practice, after very briefly discussing their design. The fact that these decoding algorithms (or some of their variants) are used in many practical applications is the main motivation for this course.

*The goal of the course is to make the student very familiar with modern codes and their decoding techniques.*

**COURSE TOPICS :**

**(please list the order in which they will be covered)**

1. Decoding Reed Solomon Codes – Fast Algorithms that decode upto Half Minimum Distance
2. List Decoding of RS codes - decoding beyond half of minimum distance
3. Decoding LDPC Codes (Belief Propagation Decoding)
4. Polar Codes - Encoding and Decoding (Successive Cancellation Decoding + SC List Decoding)
5. Reed Muller Codes - Decoding techniques old and new.

**PREFERRED TEXT BOOKS:**  
  
No specific text books. Material required (including book-excerpts, papers, course notes, etc) will be informed during the course. Student can refer to similar recent courses offered by others in the below links.

1. <http://people.seas.harvard.edu/~madhusudan/courses/Spring2020/> - Madhu Sudan
2. <https://user.eng.umd.edu/~abarg/ECC/> - Alexander Barg
3. <https://ece.iisc.ac.in/~nkashyap/E2_205/> - Navin Kashyap, P Vijay Kumar

**\*REFERENCE BOOKS:**

**\*PROJECT:**

**GRADING PLAN:** Since the course is mainly about decoding algorithms, it will involve many programming assignments. Python will be preferred, Matlab is also permitted. There will be a term paper (on a particular topic the student is expected to read some papers, write a report and deliver a presentation). Short quizzes will be covering the remaining marks. There will not be any written exams.

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| **Type of Evaluation** | **Weightage (in %)** |
| Quizzes |  |
| Assignments (PROGRAMMING in Python or Matlab) | **50 (3-4 assignments)** |
| Term paper | **30 marks** |
| Project |  |
| Open book exam or 30 minute quiz | **20 marks** |
| Other Evaluation \_\_\_\_\_\_\_\_\_ |  |

**OUTCOME: At the end of the course the student is expected to feel confident about reading current literature on the topics discussed in this course, and also in designing decoding algorithm of codes used in practical applications to a reasonable extent. Research aptitude will be naturally developed if the student does well in the course, as the course runs through many important and recent academic research contributions in the field of Channel Coding.**

**REMARKS: Maximum number of registrations in this course will be 10** *(If more than 10 sign up then preference will be given based on verification of prerequisite knowledge or requirement for research).*