• **Instructor**: Dr. Ravi Tandon
• **E-mail**: tandonr@email.arizona.edu
• **Contact**: 520-626-9627 (Office)

• **Lecture Timing and Location**: M, W, F 11:00am-11:50am, ECE Building, Room 102.

• **Office Hours**: Monday 1:30pm-3:30pm (ECE 359) (Additional office hours by appointment)

• **Course Summary**: This is a special topics course focusing on information theory and its applications in communications, networks, security, statistics, and machine learning. We will first review the basics of information theoretic concepts, and then cover their applications to several contemporary and emerging areas. Some of the topics and applications which will be covered in this course are: a) fundamental limits of communication over wired and wireless networks; b) information theoretic security, wiretap channels, and Physical Layer Security; c) network coding, index coding, and their applications; d) information theory for distributed storage and computation; and e) statistics and machine learning. The material covered in this course will be taken from both textbooks as well as recent conference and journal papers. Students will be expected to perform a research project with an information theoretic focus, which will be an integral part of the course.

• **Course Prerequisite**: ECE 503 (Probability, and Random Processes) or an equivalent graduate level course on Probability. NOTE: Prior background or coursework on Information Theory is a plus but not necessary.

• **Reference Books and Other Sources**:
  – David MacKay, Information Theory, Inference, and Learning Algorithms, Cambridge University Press (PDF available online)
  – Journals: IEEE Transactions on Information Theory, Networking,
  – Conferences: NIPS, ICML, ISIT, INFOCOM.

• **Recommended study habits**: Attend the lectures, take notes, ask questions and do your homework. After each lecture, I will also assign reference material for further reading on the topic being covered.

• **Grading**:
  – Homework (20%) - A total of 4-5 homeworks; each homework will be due in 1 week.
  – Lecture Scribe (10%)
  – Class Participation (10%)
  – Presentation (20%) - Date: TBD, (in class)
  – Final Project (40%) - Due Date: TBD.

• **Homework Submission**: All homeworks and lectures will be posted on D2L (https://d2l.arizona.edu/). Mode of submission of HWs: submit in my mailbox (2nd floor, ECE Building).
1. Module 1: Basic Information Theory (2 weeks)
   • Review of Information Measures and Basic Concepts
   • Point-to-Point Channel Capacity

2. Module 2: Network Information Theory (2 weeks)
   • Multi-user Channel Capacity (Broadcast, Multiple-access channels)
   • Interference Networks and recent advances

3. Module 3: Information Theoretic Security (2 weeks)
   • Information Theoretic Security
   • Wiretap Networks/Secret Key Agreement
   • Recent developments in Physical Layer Security
   • Private Information Retrieval

4. Module 4: Emerging Applications (4 weeks)
   • Network Coding, Index Coding & Applications
   • Coding for Distributed Storage
   • Coding for Distributed Machine Learning
   • Other Information Theoretical aspects in Statistics and Machine Learning

5. Module 5: Student Presentations (Week 11 - End)

   • Student Code of Academic Integrity
     Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, homeworks must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See: http://deanofstudents.arizona.edu/codeofacademicintegrity/.

   • Accessibility and Accommodations:
     It is the University’s goal that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on disability or pregnancy, please let me know immediately so that we can discuss options. You are also welcome to contact Disability Resources (520-621-3268) to establish reasonable accommodations.