Indian Institute of Technology Bombay

Department of Electrical Engineering

EE 325 : PROBABILITY AND RANDOM PROCESSES

Time and location: Wednesday and Friday 9:30am-11:00am at Room: xxx

Web page: `http://www.ee.iitb.ac.in/~bsraj/courses/ee325`

Instructor:
Sibi Raj B Pillai
331A, Electrical Engineering
Phone: 7419
E-mail: `bsraj att ee`
Timings: call and walk-in

Assistants:
1) TBA
2) TBA
3) TBA
4) TBA

Contents:

Sets and operations, Probability space, Conditional probability and Bayes theorem, Combinatorial probability and sampling models.

Discrete random variables, probability mass function, probability distribution function, example random variables and distributions.

Continuous random variables, probability density function, probability distribution function, example distributions.

Joint distributions, functions of one and two random variables, moments of random variables.

Conditional distribution, densities and moments, characteristic functions, Markov, Chebyshev and Chernoff bounds, Detection and Estimation.

Random sequences and modes of convergence (everywhere, almost everywhere, probability, distribution and mean square), Limit theorems, Strong and weak laws of large numbers, central limit theorem.

Random processes, Markov Chains, Stationary processes, Mean and covariance functions, Ergodicity, Linear filtering of random processes, Power spectral density.

Course mechanics:

Assignments [25%] (will appear in every exam)
4 exams [15+30+15+40]

Textbook: There are many good text-books on probability theory, grab any. Selected slides/lecture-notes will be posted on the website.

Reference Material: (Introductory)

1. A. Papoulis and S. Unnikrishna Pillai, *Probability, Random Variables and Stochastic Processes*, McGrawHill.
2. H. Stark and J. W. Woods, *Probability and Random Processes with applications to Signal Processing*, Pearson Education.
3. S. Kay, *Intuitive Probability and Random Processes*, Springer 2006.
4. W. Feller, *An Introduction to Probability*, Wiley, 1968.
5. S. Ross, *Stochastic Processes*, Wiley 1996
6. B. Hajek, `http://www.ifp.illinois.edu/~hajek/Papers/probability.html`.
7. V. K. Rohatgi and A. K. Md. E. Saleh, *An Introduction to Probability and Statistics*, Wiley 2001.

Reference Material: (Advanced)

1. K. L. Chung, *A Course in Probability Theory*, Birkhauser, 1998.
2. Fristedt and Grey, *A Modern Approach to Probability Theory*, Birkhauser, 1998.
3. S. Resnick, *A Probability Path*, Birkhauser 2001.
4. R. Durrett, *Probability, Theory and Examples*, Cambridge 2010 (First 1991).

Attendance:

Attendance is to be maintained as per IITB rules. Attendance is compulsory for tutorial sessions. Students are strongly advised to participate in all sessions. The lectures at times can appear a bit monotonous (usually the case for those who come without going over the events in detail from the previous lecture). The request for attendance is not to make a case for forceful learning, but we take more of a practitioner's view on probability than a pure theorist's, and it is better and easier to learn this in class than outside.

Is this useful?

A large fraction of students who did $EE325$ in the regular EE batches did echo that several other advanced courses, job interviews, main projects etc became extremely accessible due to a smooth sailing in this course. So the impact is clear. Furthermore, EE department offers a number of advanced probability courses, a wonderful opportunity to build on what you learn here.

Lecture Notes

A set of lecture notes were made in the previous years, for parts of the syllabus. Needless to say that it was made possible not only by the instructor's writing (which is BPL), but many students also contributed in updating the postings. This is sincerely acknowledged, and the same kind of support from all of you is expected. In fact, more notes will be provided whenever the past notes accumulate more than a specific number of comments.