INTRODUCTION TO STOCHASTIC PROCESSES

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PRE-REQUISITES : Introductory real analysis

INTENDED AUDIENCE : All disciplines

INDUSTRIES APPLICABLE TO : This is a basic course. All companies will recognize

COURSE OUTLINE :
Randomness is a common thing that we came across in our daily life. Questions like how much traffic will be on my route today? how much I need to wait to catch a bus to my workplace? will I gain or lose money in stock market? may not have fixed answers as they are associated with events that are not in our control and could be treated as random. In this course, we will learn various probability techniques to model random events and study how to analyze their effect.

ABOUT INSTRUCTOR :
Prof. Manjesh K. Hanawal received the M.S. degree in ECE from the Indian Institute of Science, Bangalore, India, in 2009, and the Ph.D. degree from INRIA, Sophia Antipolis, France, and the University of Avignon, Avignon, France, in 2013. After two years of postdoc at Boston University, he is now an Assistant Professor in Industrial Engineering and Operations Research at the Indian Institute of Technology Bombay, Mumbai, India. His research interests include performance evaluation, machine learning and network economics. He is a recipient of Inspire Faculty Award from DST and Early Career Research Award from SERB

COURSE PLAN :

Week 1**:** Introduction to events, probability, conditional probability, Bayes rule

Week 2**:** Random Varaibles, Expectations, Variance, Various type of distributions

Week 3**:** CDF and PDF of random variables. Conditional CDF and PDFs

Week 4**:** Jointly distributed random variables, covariance and independence

Week 5**:** Transformation of random variables and their distributions

Week 6**:** Introductions to Random processes. Stationary and Ergodicity

Week 7**:** Convergence of Sequence of RVs.

Week 8**:** Strong and weak law of large numbers, central limit theorem

Week 9**:** Discrete Markov chains. Stopping time and Strong Markov property Classification of Transient and Recurrent states

Week 10**:** Counting Process, Poisson Processes and its applications

Week 11**:** Renewal Theory. Elementary and Renewal Reward Theorem

Week 12**:** Introduction to Continuous Markov Chains