

## Stochastic Processes II

**Department:** MATH

**Course Number:** 6762

**Hours - Lecture:** 3

**Hours - Lab:** 0

**Hours - Recitation:** 0

**Hours - Total Credit:** 3

**Typical Scheduling:** Every spring semester

**Description:**

Continuous time Markov chains. Uniformization, transient and limiting behavior. Brownian motion and martingales. Optional sampling and convergence. Modeling of inventories, finance, flows in manufacturing and computer networks. (Also listed as ISyE 6762)

**Prerequisites:**

[Math 6761](#)

**Course Text:**

At the level of Kulkarni, *Modeling and Analysis of Stochastic Systems*, and Karlin and Taylor, *A First Course in Stochastic Processes*

**Topic Outline:**

Continuous Time Markov Chains (CTMC)

Markov property

Sample path property

Birth-death process

Embedded DTMC

Chapman-Kolmogorov equations

Transient probabilities

Transience and recurrence criterion

Limiting behavior

Stationary distribution

Network of queues

Reversibility

Random Walks, Martingales, and Brownian motions

Simple random walk as DTMC

Definition of martingales

The optional sampling theorem

Martingales associated with random walks

Hitting probabilities

Expected hitting times

Connection with renewal process

Brownian motions

Martingales associated with a Brownian motion

Hitting times of a Brownian motion

Expected hitting times

Connection with renewal process

Brownian motions

Martingales associated with a Brownian motion

Hitting times of a Brownian motion

Functional strong law of large numbers

Functional central limit theorems for random walks and renewal processes

One dimensional reflecting Brownian motion

Approximate analysis of G/G/1 queue and other systems