Syllabus for ECE Qualifying Examination
Subject Area: Random Processes and Probability

Reference:

Basic Concepts:
Sample spaces, probability measures, outcomes, events, combinatorial approaches to computing probabilities, conditioning, total probability, independence, Bayes’ rule.

Random Variables:
Definition of, probability mass functions (PMFs), probability density functions (PDFs), cumulative distribution functions (CDFs), commonly used distributions, expectations, characteristic functions, moment inequalities.

Random Vectors:
Definition of, joint PMFs, PDFs, and CDFs, joint characteristic functions, conditional distributions and conditional expectation, joint moments, covariance matrices and their properties, jointly Gaussian random variables.

Limit Theorems:
Law of large numbers, central limit theorem.

Estimation:
LLSE and MMSE estimators.

Detection:
MAP and ML detectors.

Second-Order Random Processes:
Stationarity and wide-sense stationarity, autocorrelation, power spectral density, white noise, filtered random processes.

Discrete-Time Markov Chains:
Definition, conditions for stationarity, n-step transition probabilities, stationary distributions, occupancy rates.

Continuous-Time Markov Chains:
Definition, conditions for stationarity, the forward and backward equations, Poisson processes, the M/M/1 queue, occupancy rates.