

# Course Syllabus

## EE 549 – Queueing Theory

### USC, Spring 2009

#### I. COURSE INFORMATION

##### *Instructor:*

Michael J. Neely (EEB 520, mjneely@usc.edu, 213-740-3505)  
Office Hours: Monday/Wednesday 1:30-3:00pm (EEB 520)

##### *Teaching Assistant:*

TBA  
Office Hours: TBA

##### *Class Location and Time:*

OHE 100C, Monday/Wednesday 9:30am-10:50am

##### *Electronic Documents and DEN:*

Electronic documents for this course will be routinely available on the DEN website: <http://den.usc.edu/>

##### *Textbook:*

This course will use a combination of instructor handouts, lecture notes, and the following textbook:

- *Introduction to Probability Models* by Sheldon Ross (8<sup>th</sup> edition)

For students interested in supplemental reading, the following queueing theory texts are recommended (but not required):

- 1) Chapter 3 of *Data Networks* by D. Bertsekas and R. Gallager (Little's Law, Reversibility, and M/G/1 systems)
- 2) *Discrete Stochastic Processes* by R. Gallager (Renewal Theory and Markov Chains)
- 3) *Queueing Systems*, Vol. 1, by L. Kleinrock (M/G/1, G/M/1 systems, transients, transform methods)

##### *Grading:*

There will be problem sets, 2 mid-terms, and a final exam, to be weighted in an overall score as follows:

Homework/Participation: 10%, Midterm1: 27%, Midterm2: 27%, Final: 36%

The following minimum letter grades are guaranteed to students scoring within the specified intervals:

75-100 A, 70-75 A-, 65-70 B+, 55-65 B, 50-55 B-, 45-50 C+, 35-45 C, 30-35 C-

The above thresholds may be adjusted at the end of the semester at the discretion of the instructor. Any such adjustments will be in favor of a higher letter grade. Class participation may also factor into the homework score. There may be occasional pop quizzes given in class, worth points toward the homework/participation score.

##### *Assignments:*

The midterms and final exams from last year can be found here: <http://www-rcf.usc.edu/~mjneely/ee549/>

You are expected to do these problems, but you will not turn them in. Graded homework will be based on *designing your own problems*. Specifically, you will design your own problems based on the lecture material from that week. All problems will be scanned into DEN for everyone to see, and you may occasionally be asked to objectively grade someone else's problem (giving it a score, for example, of 0, 1, or 2).

##### *Exam Dates and Times:*

(You are expected to make all of these exam times! Note the extra time allowed for Midterms 1 and 2.)

Midterm 1: Wednesday, Feb. 25, 9:30-11:30am (location TBA)

Midterm 2: Wednesday, April 15, 9:30-11:30am (location TBA)

Final Exam: Friday, May 8, 8am-10am (location TBA)

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*Statement for Students with Disabilities:*

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.

*Statement on Academic Integrity:*

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect ones own academic work from misuse by others as well as to avoid using anothers work as ones own. All students are expected to understand and abide by these principles. Scampus, the Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A: <http://www.usc.edu/dept/publications/SCAMPUS/gov/>. Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: <http://www.usc.edu/student-affairs/SJACS/>.

Plagiarism (copying or modifying someone else's work and presenting it as your own) and other forms of cheating will not be tolerated. Please ask the TA or instructor if you have questions about proper behavior.

## II. TENTATIVE COURSE OUTLINE:

Holidays: Jan. 19, Feb. 16, March 16-21.

*Sample Path Analysis*

Jan. 12, 14 — Rates and the Law of Large Numbers, Renewals, Intro to Queueing Dynamics  
 Jan. 19 — Martin Luther King Holiday (no classes)  
 Jan. 21 — Multiplexing and Tracking Theorems  
 Jan. 26, 28 — Join the Shortest Queue, Rate Stability, Capacity Regions for Networks  
 Feb. 2, 4 — Leaky Bucket Envelopes, Network Calculus  
 Feb. 9, 11 — Worst Case Delay Analysis, Traffic Filters, Priority Service  
 Feb. 16 — President's Day Holiday (no classes)  
 Feb. 18 — Minimum Clearance Time Problems and IMET  
 Feb. 23 — IMET for switches, Little's Theorem  
 Feb. 25 — Midterm 1

*Discrete Time Queueing*

March 2, 4 — Bernoulli Queues and Steady State Analysis, Markov Chains, Global and Local Balance Equations  
 March 9, 11 — Coupling, Reversibility, Transform Methods and Tail Behavior  
 March 16, 18 — Spring Break

*Continuous Time Queueing*

March 23, 25 — Poisson Process, Random Sampling, PASTA  
 March 30, 1 — M/M/m systems, Finite buffer systems  
 April 6, 8 — Continuous Time Reversibility, Jackson Networks, Inspection Paradox  
 April 13 — Renewal Theory and M/G/1 Queues  
 April 15 — Midterm 2  
 April 20, 22 — Queues with Vacations, Busy Periods  
 April 27, 29 — Equivalent Models for Tree Networks, Special Topics  
 May 8 (Friday) — Final Exam (8am - 10am)

Note: I may need to reschedule one or two classes (and the corresponding office hours) due to conference travels this semester. The rescheduled class date/time will be announced in advance. You are encouraged to attend, and the lecture will also be taped on DEN for those who are unable to attend.