
ECE 8480

Telecommunication Network Modeling and Analysis

Class Location/Time:	223 Riggs Hall, Mondays, Wednesdays, and Fridays, 10:10 – 11:00 am.
Instructor:	Associate Professor Harlan B. Russell (harlanr@clemson.edu) 316 Fluor Daniel Building, Tel: 656-7214
Course Modality:	MODIFIED TRADITIONAL
Office Hours:	Thur., and Fri., 3:30-5:00 p.m. Other times by appointment
Prerequisites:	Background in probability at the level of ECE 3170. A general introductory class on computer networks such as ECE 6380 or CPSC 8250.

Course Description

The course will focus on analysis of networking protocols rather than focus on specific implementations. We will primarily examine link and network layer protocols and will also consider some transport protocols relating to flow and congestion control. Where appropriate we will use queueing theory and Markov chains to evaluate the performance of different protocols.

A solid background in probability theory is required (at a minimum this means a very solid understanding of ECE 3170 or MTHSC 4000/6000 or MTHSC 8000 or some equivalent). You should have taken at least one additional class that applies probability to studying a system (e.g., ECE 6400, ECE 4270, ECE 6300, MTHSC 6410 Introduction to Stochastic Models, or some similar class).

Required Materials

Required textbook:	Bertsekas and Gallager, <i>Data Networks</i> , second edition, Prentice-Hall, 1992. Available online: http://web.mit.edu/dimitrib/www/books.htm
Optional textbook:	Kleinrock, <i>Queueing Systems, Vol. 1: Theory</i> , Wiley, 1975 (library has two copies)

Topical Outline

1. Brief Introduction and Review of Computer Networking
2. Delay Models
 - Queueing models
 - M/M/1 and M/G/1 queues
 - Reservation and polling systems
3. Multiple-access Communication
 - Aloha and stability
 - Multiple-access algorithms and reservations

4. Routing and Flow Control
Dynamic routing algorithms
Stability issues

Grading

Homework assignments:	15%
2 Midterm exams:	20% each
Final Exam:	45%

A – 90% - 100%; B – 80-89%; C – 70-79%; & F – < 70%

Additional Policies

Homework: All problem sets are due at the time and date specified on the assignment. No late assignments will be accepted, and they are due at the time class begins.

Examinations: No make-up exams will be given unless an acceptable reason is presented to the instructor at least one week before the examination date. We shall have two in-class exams and a final exam. The final exam is scheduled for Tuesday, April 27 from 3:00 pm – 5:30 pm.

Testing will be online using Canvas tools, including the final exam. Details to be provided near exam times. In the event of an emergency, the student must make direct contact with the instructor before an exam takes place or an assignment is due, preferably via email. If it is not possible to make arrangements before the scheduled event, then the student must contact the instructor as soon as it is safe and reasonable to do so. It is the student's responsibility to secure documentation of emergencies.

Re-grades: Re-grade requests must be submitted in writing on a separate piece of paper within one week of the return of the graded item.

Academic Integrity:

As members of the Clemson University community, we have inherited Thomas Green Clemson's vision of this institution as a 'high seminary of learning.' Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form. In instances where academic standards may have been compromised, Clemson University has a responsibility to respond appropriately to charges of violations of academic integrity. Further information on Academic Integrity can be found in the [Undergraduate Announcements](#) and in the [Graduate School Policy Handbook](#).

We encourage you to discuss interpretations of problems and assignments with each other but we expect that you will construct and write up your own solutions to any assignments that you turn in for credit. If students are found to have collaborated excessively or to have blatantly cheated (e.g., by

copying or sharing answers or computer code), all involved will at a minimum receive grades of 0 for the first infraction. Further infractions will result in failure in the course and possibly recommendation for dismissal from the university.

For the programming assignments it is okay to talk with your classmates about the ideas. But when it comes time to write up your answers we expect your words and computer code to be yours alone. Do not share your work with your classmates, as they may not have the same work ethic as you do. Do not ask your classmates to share their files with you, either. In the end, your work should be a reflection of what you understand about the topic, presented in your own words and computer code.

Class Cancellation Policy:

Class is cancelled if the instructor is more than 15 minutes late to class.

Attendance Policy:

As a modified traditional course, attendance is not mandatory, but highly encouraged. Note students who are attending in-person classes in traditional courses and are not approved to be online for all spring semester are expected to return to in-person attendance once cleared by the University. Students that must quarantine/isolate will not suffer any grade penalties associated with their physical absence from in-person classes.

In person attendance is optional on days a student is to come physically. You are expected to participate synchronously in all lectures either in person or online. If you miss class, you are responsible for the material covered in the lecture and for any assignment made.

To maintain physical distancing, individuals arriving first to the classroom should sit farthest from the door. Similarly, at the conclusion of class, students closest to the door should leave first.

While on campus, face coverings are required in all buildings and classrooms. Face coverings are also required in outdoor spaces where physical distance cannot be guaranteed. If a student does not have a face covering or refuses to wear an approved face covering without valid documented accommodation, the instructor will ask the student to leave the academic space and may report the student's actions to the Office of Community & Ethical Standards as a violation of the Student Code of Conduct. If the student's actions disrupt the class to the extent that an immediate response is needed, the instructor may call the Clemson University Police Department at 656-2222.

For a student who reports testing positive or is being asked to quarantine because of exposure to the COVID-19 virus, it will be up to the student to inform the instructor that they will be moving to online only instruction for at least the next two weeks. Students are directed to use the Notification of Absence form in Canvas to initiate this notification, which can be found under the "Help" button on the left navigation. Additional communication via email is encouraged; students should follow up with their instructor to develop a continued plan of study for each course. Students cannot be penalized in their grade for needing to move to online instruction

Notification of Absence

The Notification of Absence module in Canvas allows students to quickly notify instructors (via an email) of an absence from class and provides for the following categories: court attendance, death of family member, illness, illness of family member, injury, military duty, religious observance, scheduled surgery, university function, unscheduled hospitalization, other anticipated absence, or other unanticipated absence. The notification form requires a brief explanation, dates and times. Based on the dates and times indicated, instructors are automatically selected, but students may decide which instructors will receive the notification. This does not serve as an “excuse” from class, and students are encouraged to discuss the absence with their instructors, as the instructor is the only person who can excuse an absence. If a student is unable to report the absence electronically, he/she may call the Office of Advocacy and Success at 864-656-0935 for assistance and guidance.

The Office of Advocacy and Success also assists students in identifying various appropriate methods of documenting absences and assists families in using the electronic Notification of Absence system when students are unable to do so themselves

Academic Continuity Plan

In the event the physical classroom facility becomes unavailable, as determined by the University’s administration, class will be conducted in a virtual (online) format. The University issues official disruption notifications through email /www /text notification/social media. When notified, use one of the following links to navigate to Clemson Canvas where you will find important information about attending class:

- Primary access link: <https://www.clemson.edu/canvas>
- Secondary access link, if needed: <https://clemson.instructure.com/>
- You can also use the Canvas Student App.

Inclement Weather Policy

Any exam that was scheduled at the time of a class cancellation due to inclement weather will be given at the next class meeting unless contacted by the instructor. Any assignments due at the time of a class cancellation due to inclement weather will be due at the next class meeting unless contacted by the instructor. Any extension or postponement of assignments or exams must be granted by the instructor via email or Canvas within 24 hours of the weather related cancellation

Accessibility Statement

Clemson University values the diversity of our student body as a strength and a critical component of our dynamic community. Students with disabilities or temporary injuries/conditions may require accommodations due to barriers in the structure of facilities, course design, technology used for curricular purposes, or other campus resources. Students who experience a barrier to full access to a class should let the instructor know and make an appointment to meet with a staff member in Student Accessibility Services as soon as possible. You can make an appointment by calling 864-656-6848 or by emailing studentaccess@lists.clemson.edu. Students who receive Academic Access Letters are strongly encouraged to request, obtain, and present these to their instructors as early in the semester as possible so that accommodations can be made in a timely manner. It is the student’s responsibility to

follow this process each semester. You can access further information here:
<http://www.clemson.edu/campus-life/campus-services/sds/>.

Title IX Statement:

Clemson University is committed to a policy of equal opportunity for all persons and does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender, pregnancy, national origin, age, disability, veteran's status, genetic information or protected activity in employment, educational programs and activities, admissions and financial aid. This includes a prohibition against sexual harassment and sexual violence as mandated by Title IX of the Education Amendments of 1972. The University is committed to combatting sexual harassment and sexual violence. As a result, you should know that University faculty and staff members who work directly with students are required to report any instances of sexual harassment and sexual violence, to the University's Title IX Coordinator. What this means is that as your professor, I am required to report any incidents of sexual harassment, sexual violence or misconduct, stalking, domestic and/or relationship violence that are directly reported to me, or of which I am somehow made aware. There are two important exceptions to this requirement about which you should be aware:

Confidential Resources and facilitators of sexual awareness programs such as "Take Back the Night and Aspire to be Well" when acting in those capacities, are not required to report incidents of sexual discrimination.

Another important exception to the reporting requirement exists for academic work. Disclosures about sexual harassment, sexual violence, stalking, domestic and/or relationship violence that are shared as part of an academic project, a research project, classroom discussion, or course assignment, are not required to be disclosed to the University's Title IX Coordinator.

This policy is located at <http://www.clemson.edu/campus-life/campus-services/access/title-ix/>. Ms. Alesia Smith is the Executive Director for Equity Compliance and the Title IX Coordinator. Her office is located at 223 Holtzendorff Hall, phone number is 864.656.3181, and email address is alesias@clemson.edu.

Safe Campus:

Clemson University is committed to providing a safe campus environment for students, faculty, staff, and visitors. As members of the community, we encourage you to take the following actions to be better prepared in case of an emergency:

- a. Ensure you are signed up for emergency alerts (<https://www.getrave.com/login/clemson>)
- b. Download the Rave Guardian app to your phone (<https://www.clemson.edu/cusafety/cupd/rave-guardian/>)
- c. Learn what you can do to prepare yourself in the event of an active threat (<http://www.clemson.edu/cusafety/EmergencyManagement/>)

Copyright Statement:

Materials in this course are copyrighted. They are intended for use only by students registered and enrolled in this course and only for instructional activities associated with and for the duration of the course. They may not be retained in another medium or disseminated further. They are provided in compliance with the provisions of the Teach Act. Students should be reminded to refer to the Use of Copyrighted Materials and “Fair Use Guidelines” policy in on the Clemson University website for additional information: <https://clemson.libguides.com/copyright>.

Modification Statement:

The instructor reserves the right to modify any aspect of the syllabus at any time during the semester for reasons including but not limited to COVID-related situations.

Date of last update: January 5, 2021.