BUS Q785 Queueing Theory and Its Applications
Fall 2021 Course Outline

Operations Management Area
DeGroote School of Business
McMaster University

COURSE OBJECTIVE

Queueing theory has numerous applications in manufacturing, inventory, service and communication systems. The main objective of this course is to help students develop an in-depth understanding of different types of queueing models and their applications to real-world business problems. We will discuss both the classical theories and some contemporary applications, through which students will learn how to model, analyze and optimize queueing systems.

INSTRUCTOR AND CONTACT INFORMATION

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Office Hours: By appointment
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COURSE DESCRIPTION

Queueing theory is concerned with the analysis and design of waiting lines arising in a wide variety of service, manufacturing, and communications systems. This course will start with a brief review of stochastic processes used in modelling queuing phenomena. This will be followed with a discussion of Markovian queues. The imbedded Markov chain models, the G/G/1 queue, queueing network models, simulation of will also be discussed..

LEARNING OUTCOMES

Upon successful completion of this course, students will be able to complete the following key tasks:

- Develop an in-depth understanding of the basic queueing models
- Formulate queueing models to solve operational problems
- Solve queueing problems analytically and computationally

COURSE MATERIALS AND READINGS

Textbook:

U. N. Bhat. An Introduction to Queueing Theory: Modeling and Analysis in Applications. (Available to download from McMaster library)

Readings.

A reading list of papers will be provided

EVALUATION

Components and Weights

Assignment 1 (Due around Week 4)	15%
Assignment 2 (Due around Week 8)	15%
Assignment 3 (Due around Week 12)	15%
Course Project	20%
Participation	10%
Final Exam	25%
Total	**100%**

Conversion

At the end of the course your overall percentage grade will be converted to your letter grade in accordance with the following conversion scheme.

Grade	Points	Equivalent Percentages
A+	12	90 – 100
A	11	85 – 89
A-	10	80 – 84
B+	9	77 – 79
B	8	73 – 76
B-	7	70 – 72
F	0	69 and under

Course project

Each student will need to submit a research proposal consistent of the following components:

1. Identification of a research problem related to queueing theory, and the research question(s), 0-2 pages
2. Literature survey 1-2 pages
3. Formulation of the problem 1-2 pages
4. Preliminary analysis (a high-level plan for solving the problem)

Please review the Graduate Examinations Policy (if applicable):
http://www.mcmaster.ca/policy/Students-AcademicStudies/GradExamsPolicy.pdf

ACADEMIC INTEGRITY

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity.

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: “Grade of F assigned for academic dishonesty”), and/or suspension or expulsion from the university.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at:

www.mcmaster.ca/academicintegrity

The following illustrates only three forms of academic dishonesty:

1. Plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
2. Improper collaboration in group work.
3. Copying or using unauthorized aids in tests and examinations

MISSED ACADEMIC WORK

Late assignments will not be accepted. No extensions are available except under extraordinary circumstances. Please discuss any extenuating situation with your instructor at the earliest possible opportunity.

STUDENT ACCESSIBILITY SERVICES

Students who require academic accommodation must contact Student Accessibility Services (SAS) to make arrangements with a Program Coordinator. Academic accommodations must be arranged for each term of study. Student Accessibility Services can be contacted by phone 905-525-9140 ext. 28652 or e-mail sas@mcmaster.ca.

For further information, consult McMaster University's Policy for Academic Accommodation of Students with Disabilities:

http://www.mcmaster.ca/policy/Students-AcademicStudies/AcademicAccommodation-StudentsWithDisabilities.pdf

ACADEMIC ACCOMMODATION FOR RELIGIOUS, INDIGENOUS OR SPIRITUAL OBSERVANCES (RISO)

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students requiring a RISO accommodation should submit their request, including the dates/times needing to be accommodated and the courses which will be impacted, to their Program Office normally

within 10 days of the beginning of term. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

POTENTIAL MODIFICATION TO THE COURSE

The instructor reserves the right to modify elements of the course during the term. There may be changes to the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.

(TENTATIVE) COURSE SCHEDULE

SESSION	TOPIC
Week 1 - Week 2	Introduction to queueing theory, review of probability theory and stochastic processes
Week 3 & Week 4	Markovian systems: M/M/1 queue, M/M/c queue, M/M/c/N queue, birth and death queue
Week 5 & Week 6	Embedded Markov systems: M/G/1 queue, GI/M/1 queue Non-Markov systems: GI/G/1
Week 7 & Week 8	Queueing networks, priority queues
Week 9 & Week 10	Applications of queueing models in operations management
Week 11 & Week 12	Simulation, approximation methods
Week 13	Other topics in queueing theory