MATH 4011 – Real Analysis III
FALL 2019

Instructor's Information
Instructor: Paul Skoufranis
E-mail: pskoufra at yorku.ca
Office: Ross Building, South 625
Offices Hours: Tuesdays 8:45AM-9:45AM and 3:30PM-4:30PM
Thursdays 2:30PM-3:30PM
By appointment

Administrative Information
Course Prerequisites: SC/MATH 3210, or both SC/MATH 3001 and SC/MATH 2310
Course Webpage: http://pskoufra.info.yorku.ca/teaching/f2019-math-4011/
Lectures: Tuesdays and Thursdays from 10:00AM to 11:30AM in CB 120
Textbook: *Real Analysis,* Cambridge University Press, N.L. Carothers (recommended)
Midterm Examination Date: Thursday October 31st, 2019.
Final Examination Date: TBA. The final examination will be comprehensive and will be scheduled by the registrar during the December exam period. The final examination will be a closed book examination.

Course Description and Objectives
   At this point students have mainly studied analysis for real numbers and continuous functions on the real line. However, if one takes a moment and thinks back to how arguments worked in previous analysis courses, everything revolves around taking limits of sequences. Furthermore, to take a limit of a sequence, one needs only a notion of what it means for one element to be close to another. This works well for real numbers by asking for the absolute value of the difference between two numbers to be small. However, there are only certain properties required of this distance in order to make our arguments work.
   In this course, we will study what happens when we extend our basic analytic tools and techniques to a wider variety of spaces which are equipped with distance functions known as metrics. In particular, one focus of this course will be normed linear spaces which combine our technology from analysis and linear algebra to provide a truly powerful theory. The main topics of this course are the notions of topologies, continuous functions, and compactness for these metric spaces, and we will prove many interesting theorems for Banach spaces, Hilbert spaces, and continuous functions.

Course Schedule
The following is a rough outline of material that will be covered in the lectures of this course:
1. Metric spaces
   a. Metrics
   b. Normed Linear Spaces
   c. Metric Topologies
   d. Convergent Sequences
   e. Continuous Functions
   f. Connected Sets

2. Completeness
    a. Cauchy Sequences
    b. Banach Spaces
    c. Tietz Extension Theorem
3. Banach Space Theorems
    a. Banach Contractive Mapping Theorem
    b. Baire Category Theorem
    c. Open Mapping Theorem
    d. Principle of Uniform Boundedness
4. Compact Metric Spaces
    a. Compact Sets
    b. Finite Dimensional Normed Linear Spaces
    c. Sequential Compactness
    d. Borel-Lebesgue Theorem
    e. Arzela-Ascoli Theorem
5. Stone-Weierstrass Theorem
6. Hilbert Spaces (*)

(*) indicates time permitting.

Marking Scheme

A student's final grade in the course will be computed as follows:

25% Homework Assignments + 30% Midterm Examination + 45% Final Examination

There will be approximately 6 homework assignments during the course due approximately every two weeks.

Homework Assignments

The purpose of the homework in this course is to aid students in the comprehension of the material presented in lecture each week and to expand students' knowledge beyond what can be covered in lectures. Thus the instructor will endeavour to provide students with a sufficient amount of time after the material is presented in lecture for completion of the homework.

Homework will be posted on the course webpage and students will have approximately two weeks to complete assignments. Homework will be due in class on the due date and late homework will not be accepted as solutions will be posted promptly. Students are expected to clearly indicate their names and student ID number on their homework.

Students are welcome to collaborate with each other on the homework. However, each student must write his or her solutions separately in their own words (no copying!).

Missed Assessment Policy

If you have serious issues pertaining to the examination dates (e.g. religious holiday), please contact the professor immediately. There will be no make-up assessments for assignments in this course, nor will there be any extensions. If you know you will miss an examination for a valid excuse (e.g. religious holiday, university sanctioned event, etc.), please contact the course instructor at least a week prior to the absence so alternate accommodations can be made. If you missed an examination due to a valid medical

emergency, please contact the course instructor directly and immediately. Make-up examinations will be arranged only if accompanied by a note from a medical professional (http://mech.lassonde.yorku.ca/wp-content/uploads/2015/10/attend_physician_statement.pdf).

If you missed the final exam due to a valid medical emergency, please follow the instructions for Deferred Exam Procedures (http://myacademicrecord.students.yorku.ca/deferred-standing). Download the forms for Deferred Standing and the Attending Physician's Statement, and submit the completed forms to the undergraduate office no later than 5 business days from the date of the exam. Once the forms have been approved, students will be emailed the decision regarding the deferred status. Students should also notify their instructor that they did not write the exam and explain why.

Academic Integrity

York students are required to maintain the highest standards of academic honesty and they are subject to the Senate Policy on Academic Honesty (http://secretariat-policies.info.yorku.ca/policies/academic-honesty-senate-policy-on/). The policy affirms the responsibility of faculty members to foster acceptable standards of academic conduct and of the student to abide by such standards. Students are expected to review the materials on the Academic Integrity website (https://spark.library.yorku.ca/academic-integrity-what-is-academic-integrity/).

Numerous students in Faculty of Science courses have been charged with academic misconduct when materials they uploaded to third party repository sites (e.g. Course Hero, One Class, etc.) were taken and used by unknown students in later offerings of the course. The Faculty's Committee on Examinations and Academic Standards (CEAS) found in these cases that the burden of proof in a charge of aiding and abetting had been met, since the uploading students had been found in all cases to be wilfully blind to the reasonable likelihood of supporting plagiarism in this manner. Accordingly, to avoid this risk, students are urged not to upload their work to these sites. Whenever a student submits work obtained through Course Hero or One Class, the submitting student will be charged with plagiarism and the uploading student will be charged with aiding and abetting.

Note also that exams, tests, and other assignments are the copyrighted works of the professor assigning them, whether copyright is overtly claimed or not (i.e. whether the © is used or not). Scanning these documents constitutes copying, which is a breach of Canadian copyright law, and the breach is aggravated when scans are shared or uploaded to third party repository sites.

Student Accessibility Services

York University has policies in place to ensure that all students have an equal opportunity to attain their educational goals. Accommodations related to diagnosed learning disabilities may be made through Student Accessibility Services. If you would like confidential support or academic accommodations, please visit https://accessibility.students.yorku.ca/.

Mental Health

York University aims to promote a healthy, inclusive, and supportive environment that fosters mental health and well being. For more information or if you are struggling with mental health, please see http://mhw.info.yorku.ca/.