EXPANDED COURSE DESCRIPTION

EARTH, SPACE SCIENCE AND ENGINEERING
Lassonde School of Engineering
Earth and Space Science and Engineering
LE / ESSE 4020 3.0 SECTION A
TIME SERIES AND SPECTRAL ANALYSIS
FALL 2019 / WINTER 2020

Last Modified Date: 08/06/2019

COURSE CALENDAR DESCRIPTION

Treatment of discrete sampled data involving correlation, convolution, spectral density estimation, frequency, domain filtering, and Fast Fourier Transforms. Prerequisites: LE/EECS 1011 3.00 or equivalent programming experience; SC/MATH 2015 3.00; SC/MATH 2271 3.00. PRIOR TO SUMMER 2014: Prerequisites: LE/CSE 1540 3.00 or SC/CSE 1540 3.00 or equivalent programming experience; SC/MATH 2015 3.00; SC/MATH 2271 3.00. Course credit exclusions: LE/CSE 3451 4.00, SC/CSE 3451 4.00 LE/CSE 3451 3.00, SC/CSE 3451 3.00, SC/MATH 4130B 3.00, SC/MATH 4930C 3.00.

Course Listed Courses: PHYS 4060, MATH 4060

INSTRUCTOR(S)

<table>
<thead>
<tr>
<th>Name</th>
<th>Section / Format / Term</th>
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ADDITIONAL INFORMATION

COURSE LEARNING OUTCOMES

LSE requires formal "Course Learning Outcomes". For ESSE 4020 these are below, but "matlab" is too specific, R or Python are fine, and widely used in industry.

- Understand representation of time series ("data") in the time and frequency domain
- Assess differences between continuous and discrete ("digital") data
- Evaluate the properties of auto- and cross-covariance functions and convolution
- Develop relationships between operations in the Time Domain and Fourier Analysis and Power Spectrum analysis.
- Understand the Wiener-Khintchine and Convolution Theorems
- Apply knowledge to implementation of digital filters
- Learn to use matlab to implement theoretical foundations taught in class and analyze time series in the time and frequency domains
- Use matlab to graphically represent data and results of their analysis

COURSE EVALUATION

5 Assignments/Reports - 10% each
Mid-term test - 15%
Final exam - 35%
Assignment reports should be well-documented and professional, including all matlab or R codes.

TEXTS

Two of the texts that I use are listed below. They can be accessed electronically through the library and chapters downloaded.

Time Series Analysis and Its Applications: With R Examples: R.H. Shumway and D.S. Stoffer (3rd Edition SS2011, 4th edition SS2017). So far the library has the 3rd edition only on line, but it is fine. These texts use R - which I encourage you to learn and use, but you could use Matlab, Python, Fortran, C or octave for assignments. You will need to code and run computations.

Matlab is available via http://matlab.info.yorku.ca/_

R is widely used, free, statistics software, easy to install, easy to use, easy to create plots, and with good documentation. Start at https://www.r-project.org/ or, for time series go to https://a-little-book-of-r-for-time-series.readthedocs.io/en/latest/.

TOPICS

The course will cover material that is in Chapters 1-6, 9,12 of CM2009 and 1-4 of SS2011 in some depth plus some additional material on Fourier and related spectral analyses, and selected topics from other Chapters and Appendices.

WEBSITE

Course material will be online at http://www.yorku.ca/pat/ESSE4020/

ACADEMIC INTEGRITY LINKS

• Senate Policy on Academic Honesty - http://secretariat-policies.info.yorku.ca/policies/academic-honesty-senate-policy-on/
• Academic Integrity - http://lassonde.yorku.ca/academic-integrity

STUDENT LINKS

• Student Rights and Responsibilities - http://oscr.students.uit.yorku.ca/student-conduct
• Religious Observance - https://w2prod.sis.yorku.ca/Apps/WebObjects/cdm.woa/wa/regobs
• Academic Accommodation for Students with Disabilities - http://secretariat-policies.info.yorku.ca/policies/academic-accommodation-for-students-with-disabilities-policy/
• Student Accessibility Services (SAS) - https://accessibility.students.yorku.ca/
• York University’s Policies on Sexual Violence - http://secretariat-policies.info.yorku.ca/policies/sexual-violence-policy-on/
• York University’s Policies on Gender/LGBTQ* Positive Space - http://rights.info.yorku.ca/lgbtq/

LAND ACKNOWLEDGEMENT

• We acknowledge our presence on the traditional territory of many Indigenous Nations. The area known as Tkaronto has been care taken by the Anishinabek Nation, the Haudenosaunee Confederacy, the Huron-Wendat, and the Métis. It is now home to many Indigenous Peoples. We acknowledge the current treaty holders, the Mississaugas of the New Credit First Nation. This territory is subject of the Dish With One Spoon Wampum Belt Covenant, an agreement to peaceably share and care for the Great Lakes region.
• The Indigenous Framework for York University: A Guide to Action can be found here: http://indigenous.info.yorku.ca/
• Meaning of a land acknowledgement: http://healthydebate.ca/opinions/indigenous-land-acknowledgements

Many courses utilize Moodle, York University’s course website system. If your course is using Moodle, click here to access it.

Moodle @ York University