Description: Multirate systems are systems that handle data at different sampling rates. This results in a higher efficiency of transmission, because the sampling rate can be kept lower than that needed for single rate systems. Rate changers, and filter banks, are examples of multirate systems. In this course we will study techniques that allow us to analyze and design multirate systems.

Prerequisites: EE 461

Corequisites: None

Instructor: Aryan Saadat Mehr
Office: 3B04
Phone: (306) 966-2006
Email: aryan.saadat@usask.ca

Lectures: Tuesday-Thursdays, 1:00-2:20 pm

Tutorials:

Laboratory:

Website:

Course Reference Numbers (CRNs):

Textbook: Multirate systems and filter banks, P. P. Vaidyanathan, Prentice Hall, 1993

Office Hours:

Reading List: Multirate digital signal processing, N.J. Fliege, John Wiley and Sons, 1994

Wavelets and subband coding, M. Vetterli and J. Kovacevic, Prentice Hall, 1995

Wavelets and Filter Banks, G. Strang and T. Nguyen, Wellesley-Cambridge, 1996


Assessment: The methods of assessment and their respective weightings are given below:

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignments</td>
<td>25</td>
</tr>
<tr>
<td>Project or Midterm Exam</td>
<td>Included in the assignment marks</td>
</tr>
<tr>
<td>Final Exam</td>
<td>50</td>
</tr>
</tbody>
</table>
Final Grades: The final grades will be consistent with the “literal descriptors” specified in the university’s grading system.

http://students.usask.ca/current/academics/grades/grading-system.php

For information regarding appeals of final grades or other academic matters, please consult the University Council document on academic appeals.

http://www.usask.ca/university_secretary/honesty/StudentAcademicAppeals.pdf

Course Content: EE461: Sampling and quantization, discrete time processing of continuous time signals
- Analysis of filters: All pass, minimum-phase and generalized linear phase systems
- FIR and IIR Filter design methods

Representation of discrete time signals, poly-phase and alias-component matrices of linear systems,

Changing the sampling rate,

Maximally decimated filter banks,

M-channel uniform filter banks,

Applications of signal processing in communication systems:
- Block transmission of data, zero prefix, cyclic prefix, and OFDM
- Introduction to data detection and channel identification.

Assignments: There will be weekly assignment. Some are simple exercises, while others are mini-projects.

Student Conduct: Ethical behaviour is an important part of engineering practice. Each professional engineering association has a Code of Ethics, which its members are expected to follow. Since students are in the process of becoming Professional Engineers, it is expected that students will conduct themselves in an ethical manner.

The APEGs (Association of Professional Engineers and Geoscientists of Saskatchewan) Code of Ethics states that engineers shall “conduct themselves with fairness, courtesy and good faith towards clients, colleagues, employees and others; give credit where it is due and accept, as well as give, honest and fair professional criticism” (Section 20(e), The Engineering and Geoscience Professions Regulatory Bylaws, 1997).

The first part of this statement discusses an engineer’s relationships with his or her colleagues. One of the ways in which engineering students can demonstrate courtesy to their colleagues is by helping to maintain an atmosphere that is conducive to learning, and minimizing disruptions in class. This includes arriving on time for lectures, turning cell phones and other electronic devices off during lectures, not leaving or entering the class at inopportune times, and refraining from talking to others while the instructor is talking. However, if you have questions at any time during lectures, please feel free to ask (chances are very good that someone else may have the same question as you do).

For more information, please consult the University Council Guidelines for Academic Conduct.

http://www.usask.ca/university_secretary/council/reports_forms/reports/guide_conduct.php
**Academic Honesty:** The latter part of the above statement from the APEGs Code of Ethics discusses giving credit where it is due. At the University, this is addressed by university policies on academic integrity and academic misconduct. In this class, students are expected to submit their own individual work for academic credit, properly cite the work of others, and to follow the rules for examinations. Academic misconduct, plagiarism, and cheating will not be tolerated. Copying of assignments and lab reports is considered academic misconduct. Students are responsible for understanding the university’s policies on academic integrity and academic misconduct. For more information, please consult the University Council Regulations on Student Academic Misconduct and the university’s examination regulations.

http://www.usask.ca/university_secretary/honesty/StudentAcademicMisconduct.pdf
http://www.usask.ca/university_secretary/council/academiccourses.php

**Safety:** The APEGs Code of Ethics also states that Professional Engineers shall “hold paramount the safety, health and welfare of the public and the protection of the environment and promote health and safety within the workplace” (Section 20(a), The Engineering and Geoscience Professions Regulatory Bylaws, 1997).

Safety is taken very seriously by the Department of Electrical and Computer Engineering. Students are expected to work in a safe manner, follow all safety instructions, and use any personal protective equipment provided. Students failing to observe the safety rules in any laboratory will be asked to leave.