1. **Course:** CPSC 601.63: Visualization of Scientific Data  
   **Lecture Sections:**  
   L02, MWF 10:00-10:50, Usman Alim, MS 636, 220-4362, ualim@ucalgary.ca  
   Office Hours: MW 15:00-16:00 or by Appointment

   **Course Website:** [https://d2l.ucalgary.ca/d2l/home/123341](https://d2l.ucalgary.ca/d2l/home/123341)

   **Computer Science Department Office, ICT 602, 220-6015, cpsc@cpsc.ucalgary.ca**

2. **Prerequisites:** Consent of the Department.  
   ([http://www.ucalgary.ca/pubs/calendar/current/computer-science.html#3620](http://www.ucalgary.ca/pubs/calendar/current/computer-science.html#3620))

3. **Grading:** The University policy on grading and related matters is described in sections F.1 and F.2 of the online University Calendar. In determining the overall grade in the course the following weights will be used:

   - Assignments: 25%
   - Class Participation (Paper Readings and Presentation): 25%
   - Course Project (Proposal, Report and Presentation): 50%

   This course will not have a Registrar’s Scheduled Final Exam.

   **Special Regulations affecting the Final Grade:** Each of the above components will be given a letter grade using the official University grading system. The final grade will be calculated using the grade point equivalents weighted by the percentage given above and the reconverted to a final letter grade using the official University grade point equivalents. An A+ will be awarded to those students who qualify for an A and receive an A+ for the course project.

4. **Missed Components of Term Work:** The regulations of the Faculty of Science pertaining to this matter are found in the Faculty of Science area of the Calendar. Section 3.6. It is the student’s responsibility to familiarize themselves with these regulations. See also Section E.6 of the University calendar.

5. **Scheduled Out-of-Class Activities:** REGULARLY SCHEDULED CLASSES HAVE PRECEDENCE OVER ANY OUT-OF-CLASS-TIME ACTIVITY. If you have a clash with this out-of-class activity, please inform your instructor as soon as possible so that alternative assignments can be arranged.

6. **Course Materials:**


   **Online Course Components:** Various course readings and lecture notes will be managed through D2L.

7. **Examination Policy:** Not Applicable. Students should also read the Calendar, Section G, on examinations.

8. **Approved Mandatory and Optional Course Supplemental Fees:** None.

9. **Writing across the Curriculum Statement:** In this course, the quality of the student’s writing in the weighted components of the course will be a factor in the evaluation of these components. See also Section E.2 of the University Calendar.
10. **Human Studies Statement:** See Section E.5 of the University Calendar.

11. **OTHER IMPORTANT INFORMATION FOR STUDENTS:**

   a) **Misconduct:** Academic misconduct (cheating, plagiarism, or any other form) is a very serious offense that will be dealt with rigorously in all cases. A single offence may lead to disciplinary probation or suspension or expulsion. The Faculty of Science follows a zero tolerance policy regarding dishonesty. Please read the sections of the University Calendar under Section K, Student Misconduct to inform yourself of definitions, processes and penalties.

   b) **Assembly Points:** In case of emergency during class time, be sure to FAMILIARIZE YOURSELF with the information on assembly points which can be found in each classroom and building.

   c) **Student Accommodations:** Students needing an Accommodation because of a Disability or medical condition should contact Student Accessibility Services in accordance with the Procedure for Accommodations for Students with Disabilities available at http://www.ucalgary.ca/policies/files/policies/procedure-for-accommodations-for-students-with-disabilities_0.pdf. Students needing an Accommodation in relation to their coursework or to fulfill requirements for a graduate degree, based on a Protected Ground other than Disability, should communicate this need, preferably in writing, to the Associate Head of Computer Science. Dr. Ben Stephenson, by email bdstephe@ucalgary.ca or phone 403-220-6781.

   d) **Safewalk:** Campus Security will escort individuals day or night (http://www.ucalgary.ca/security/safewalk/). Call 403-220-5333 for assistance. Use any campus phone, emergency phone or the yellow phones located at most parking lot pay booths.

   e) **Freedom of Information and Privacy:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPP). As one consequence, students should identify themselves on all written work by placing their name on the front page and their ID number on each subsequent page. For more information see also http://www.ucalgary.ca/secretariat/privacy.

   f) **Student Union Information:** VP Academic (403) 220-3911 suvpaca@ucalgary.ca SU Faculty Rep (403) 220-3913 science1@su.ucalgary.ca, science2@su.ucalgary.ca and science3@su.ucalgary.ca. Student Ombuds Office: (403) 220-6420 ombuds@ucalgary.ca, http://ucalgary.ca/provost/students/ombuds.

   g) **Internet and Electronic Device Information:** You can assume that in all classes that you attend your cell phone should be turned off unless instructed otherwise. All communications with other individuals via laptop computers, cell phones or other devices connectable to the internet in not allowed during class time unless specifically permitted by the instructor. If you violate this policy you may be asked to leave the classroom. Repeated abuse may result in a charge of misconduct.

   h) **U.S.R.I.:** At the University of Calgary feedback provided by students through the Universal Student ratings of Instruction (USRI) survey provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses (www.ucalgary.ca/usri). Your responses make a difference – please participate in USRI surveys.

   Department Approval__________________________________________Date__________________________

   *A signed copy of this document is kept on file in the Computer Science Main Office ICT 602*
Many scientific disciplines produce large quantities of measured or simulated data. The field of Visualization aims to facilitate the analysis of such data by converting it into visual representations (images, animations, abstractions etc.) through the use of efficient computational algorithms. This gives domain experts a better understanding of the scientific phenomenon being studied.

This graduate course will give students an overview of the most important techniques used in the visualization of scientific data. It consists of two parts. In the first part, the instructor will lay the groundwork and go over some fundamental techniques in scalar, vector and tensor data visualization. The second part of the course will be run like a seminar and will be more student-centric. Students will get a chance to explore an area of their choice and present a research topic that they are interested in. A major component of the course is a project that the students will propose by mid-February and present their findings to the class towards the end of the term.

**Topics Covered:**

1. **Preliminaries**  
   Data representation, grids, colour, filtering, visual variables, the visualization pipeline, visualization design.

2. **Scalar Visualization**  
   Colourmaps, contours, isosurface rendering (implicit and explicit), volume visualization (ray casting, transfer function design, GPU based volume visualization).

3. **Vector Visualization**  
   Integral curves, particle tracing, line integral convolution, stream surfaces.

4. **Tensor Visualization**  
   Glyphs, principle components, tractography.

5. **Seminar**  
   The seminar will focus on different data models that have recently become popular in the field of data visualization. Tentative topics include: approximation theory and signal processing, data structures for handling large and/or sparse datasets, uncertainty quantification and visualization, information theoretic approaches, graph theoretic approaches, multi-field and high-dimensional data visualization.