University of Victoria Engineering

Faculty of Engineering

COURSE OUTLINE

MECH 495/535 – Computational Fluid Dynamics and Heat Transfer

Term – SPRING 2016 (201601)

Instructor	Office Hours
Dr. Peter Oshkai	Days: TBA
Phone: 250-721-8922	Time: TBA
E-mail: poshkai@uvic.ca	Location: EOW 529

Lecture Schedule

Section: A01 /CRN 22234/22240	Days: Wednesday	Time: 10:30-11:20	Location: COR B108
	Days: Friday	Time: 9:30-11:20	Location: COR B108

Note: There are no tutorials throughout the term

Lab Schedule

Days: Friday	Time: TBA	Location: ELW B238

"Attendance

Students are expected to attend all classes in which they are enrolled. An academic unit may require a student to withdraw from a course if the student is registered in another course that occurs at the same time.

An instructor may refuse a student admission to a lecture, laboratory, online course discussion or learning activity, tutorial or other learning activity set out in the course outline because of lateness, misconduct, inattention or failure to meet the responsibilities of the course set out in the course outline. Students who neglect their academic work may be assigned a final grade of N or debarred from final examinations.

Students who do not attend classes must not assume that they have been dropped from a course by an academic unit or an instructor. Courses that are not formally dropped will be given a failing grade, students may be required to withdraw and will be required to pay the tuition fee for the course."

UVic Calendar, (2015) http://web.uvic.ca/calendar2015-09/FACS/UnIn/UARe/Atte.html

TA Name	E-mail	Office
Mostafa Rahimpour	mrahim@uvic.ca	TBA

Required Text
Title: Computational Fluid Dynamics
Author: T.J. Chung
Publisher/Year: Cambridge University Press, 2002

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COURSE OBJECTIVES:

Computational Fluid Dynamics and Heat Transfer has been used by leading academic and industrial R&D centres to provide insight into a variety of complicated problems: turbulent mixing and combustion, flow-induced vibration of various structures, solidification of molten metals in castings, pulsatile flow of blood in artificial heart valves, dispersion of pollutants in the atmosphere. The range of the problems that can be approached by CFD is rapidly increasing with the development of new algorithms, turbulence models, and the availability of increasingly more powerful computers.

This course will concentrate on the finite-difference and finite-volume solution methods for solving general heat transfer and fluid flow problems. Specific objectives are (i) to provide the necessary background in discretization methods, accuracy, stability and convergence aspects of numerical solutions; (ii) to develop an understanding of the capabilities and limitations of various numerical and mathematical models of fluid flow, and (iii) to introduce some of the models required to compute turbulent flows and transport processes.

LEARNING OUTCOMES:

At the end of this course, students will be able to:

1. Articulate the broad range of situations in nature and technology, which involve fluid mechanics and heat transfer, and explain the basic analysis techniques used for investigation and for design.
2. Demonstrate an understanding of the classifications of governing partial differential equations as elliptic, parabolic or hyperbolic. Appropriately use these classifications, in conjunction with appropriate boundary and initial conditions for flow and heat transfer analysis.
3. Apply the concepts of vector fields (velocity, force, acceleration), scalar fields (pressure, density, temperature), and vector differential and integral calculus to engineering analysis of systems involving fluids and heat transfer, through the interpretation and proper use of flow kinematics and dynamics.
4. Properly apply system and control volume methods based on conservation of mass, momentum, and energy, to the analysis of engineering fluids systems.
5. Demonstrate an understanding of the classification of numerical approaches such as finite differences, finite volume and finite elements, as well as the corresponding advantages and limitations.
6. Properly apply discretization methods to design numerical approaches to various engineering problems.
7. Demonstrate an understanding of the concepts of consistency, stability and convergence. Apply these concepts in the analysis of suitability of various numerical methods for a particular problem.
8. Design and apply direct and/or iterative numerical approaches for various types (elliptic, parabolic or hyperbolic) of problems by developing a working numerical code in Matlab or another programming language. Perform a parametric study of an engineering system using this code.
9. Demonstrate professionalism, and respectful interaction with faculty and colleagues in class discussions, group work and laboratory project.
10. Demonstrate capabilities of thoughtful engineering communication through written work.

ASSIGNMENTS AND PROJECT:
Individual assignments will require the application of a CFD code to investigate a problem involving fluid flow and/or heat transfer phenomena. In-class qizzes based on the assignment problems will test conceptual understanding of the specific computational approaches, as well as their properties and features. A project involving the application of the STAR CCM+ software package to perform a parametric study of a separated flow will have to be completed in order to qualify for a passing grade in this course. Further details regarding the project will be discussed in class and a handout will be available outlining the projects requirements and expectations.

In addition, MECH 495 students will be required to take a written final examination at the end of the course, and MECH 535 students will be requited to complete a term project including a written report and an oral in-class presentation.

GRADING:

MECH 495

Assessment:	**Weight**
STAR CCM+ Project	pass
Assignments:	50%
Quizzes:	10%
Final Exam:	40%

MECH 535

Assessment:	**Weight**
STAR CCM+ Project	pass
Assignments:	50%
Quizzes:	10%
Term Project:	40%

NOTE: This policy represents a guideline for the grade distribution, which can be adjusted in individual cases.

The final grade obtained from the above marking scheme for the purpose of GPA calculation will be based on the percentage-to-grade point conversion table as listed in the current Undergraduate Calendar.

Assignment of E grade and supplemental examination for this course will be at the discretion of the Course Instructor. The rules for supplemental examinations can be found in the current Undergraduate Calendar. http://web.uvic.ca/calendar2015-09/FACS/FoEn/EnPr/AcRe.html

Note to Students:

Students who have issues with the conduct of the course should discuss them with the instructor first. If these discussions do not resolve the issue, then students should feel free to contact the Chair of the Department by email or the Chair's Secretary to set up an appointment.

Accommodation of Religious Observance (AC1210)
http://web.uvic.ca/calendar2015-09/GI/GUPo.html

Discrimination and Harassment Policy (GV0205)
http://web.uvic.ca/calendar2015-09/GI/GUPo.html

Faculty of Engineering, University of Victoria
Standards for Professional Behaviour

"It is the responsibility of all members of the Faculty of Engineering, students, staff and faculty, to adhere to and promote standards of professional behaviour that support an effective learning environment that prepares graduates for careers as professionals…."

You are advised to read the Faculty of Engineering document Standards for Professional Behaviour which contains important information regarding conduct in courses, labs, and in the general use of facilities. http://www.uvic.ca/engineering/current/undergrad/index.php#section0-23

Cheating, plagiarism and other forms of academic fraud are taken very seriously by both the University and the Department. You should consult the Undergraduate Calendar for the UVic policy on academic integrity.

Policy on Academic Integrity
http://web.uvic.ca/calendar2015-09/FACS/UnIn/UARe/PoAcI.html

Course Lecture Notes

Unless otherwise noted, all course materials supplied to students in this course have been prepared by the instructor and are intended for use in this course only. These materials are NOT to be re-circulated digitally, whether by email or by uploading or copying to websites, or to others not enrolled in this course. Violation of this policy may in some cases constitute a breach of academic integrity as defined in the UVic Calendar.