Faculty of Engineering
Department of Mechanical Engineering
COURSE OUTLINE

MECH 493 – Design of Thermofluids Systems

Spring 2016 (201601)

Instructors	
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Prerequisites and co-requisites: MECH 345, MECH 390, MECH 395

LECTURE DATE(S)

Section:	Days:	Time:	Location:
A01 /CRN**22233**	Tuesday	13:30 – 16:20	ECS 108

Required Text
Title: Design of Fluid Thermal Systems
Author: William S. Janna
Publisher/Year: Cengage Learning
Note: Any edition is acceptable

COURSE OBJECTIVES:

This course is intended as a capstone design course in the area of thermo-fluid systems. In other words, it is a final design project in this field, and will be treated like a project submitted to a client's request for proposals. The textbook explains such a process very clearly. Please read carefully.

The course and the textbook are designed for the graduating class, so MECH 345 and 395 are required as prerequisites. No exceptions will me made regarding the prerequisites. A design project will normally be carried out in groups of four students. Any exceptions to this must be approved by the instructors (i.e., for groups of 3 or 5 students).

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

1. *Propose, Develop, and Assess a design project in the area of thermofluids*
   a) Identify a design problem and propose an analytical solution.
   b) Design a new system while applying knowledge of thermodynamics, fluid mechanics or heat transfer.
   c) Evaluate the anticipated performance of the new thermo-fluid system including its net economic benefit.
   d) Describe the project and assess its results in reports and live presentations.
2. *Optimize piping systems and Heat Exchangers*
   a) Combine elementary fluid mechanics and heat transfer with economic analysis to minimize the overall project costs.

Learning Outcomes next page

Weight & Date(s) of Assessments:	Weight	Date
Quiz:	20 %	February 16
Project Introduction:	5 %	January 26
Midterm Report:	35 %	March 1
Project Presentation:	10 %	March 29
Final Report:	30 %	March 29

QUIZ:

One quiz will be given covering optimization of piping systems and head exchangers which is covered very well in the textbook and which is also based largely on material you have covered in Mech 345, 390, and 395. Quizzes will be completed individually (you will receive individual marks which will have a 20% contribution towards your final grade). Quizzes are required by the Department to assign partial individual marks to group members. Quiz topics will be presented briefly in class, and problem sets will be provided to help students prepare.

PROJECTS:

Groups of four students will design a new thermal or fluid system for a real or a fictitious client. A proposal describing the potential benefit of the new fluid system and outlining the technical analysis required will be submitted in the third week of class. A midterm report will give a detailed technical design strategy, and the project will be presented to the class again at that point. A final report will specify the new system and include the project's net present value supported by an economic analysis.

Wherever appropriate, projects will include analysis related to the quiz material such as "Pumps and Piping Systems" or "Heat Exchangers." Other analyses may be proposed based on, for example, thermal modeling, mass transport, potential flow theory, etc. but all projects must include a rigorous technical component.

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.

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.

GENERAL INFORMATION

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.

"**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

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 Schedule

January 5	Select Group Members
January 12	Project Discussion
January 19	Submit **Proposal Report** in class and through Moodle. **Lecture:** Piping systems, optimal diameter
January 26	**Project Introductions**: 5 min each
February 2	**Lecture:** Heat exchangers, optimal cooling water temperature
February 9	**Reading Break**
February 16	**Quiz**
March 1	Submit **Midterm Report**
March 29	Submit **Final Report** **Project Presentations**, 15 minute presentations

Specific Guidelines for Project Deliverables

All reports must be submitted at the start of class. An electronic version must also be submitted in .pdf format to the course CourseSpaces page before midnight the same day.

The title pages of all reports must include the group number, group name, and the names and student numbers of all group members. Reports must be presented clearly and professionally, and marks may be deducted for poor grammar, illegible plots, or missing page numbers or captions.

Presentations should be no longer than the allotted time. All group members must participate in the presentations and attend the presentations of all other groups. Presentation slides should be brought to class on a flash drive. Pdf format is recommended for slides, but Power Point will be provided.

Proposal: (2-3 pages)

The project proposal will briefly outline the work to be done in broad terms. There are no marks assigned for the report, but a clear and well thought-out proposal will make for less work later. Please review the material covered by the two quizzes and choose a project that includes similar analyses. The project may be a highly detailed, optimized design of a single component such as a heat exchanger or a broader analysis of a complete system, such as a refrigerated shipping container, in which several components are chosen "off the shelf". The proposal should include the following:

1) Technical Proposal
    a) Project motivation / benefit
    b) Objectives and scope
    c) Anticipated analytical methods
2) Budget Proposal
    a) Project tasks (Gantt chart)
    b) Design consultancy budget (charge $100/hr)
    c) Estimated budget for the project implementation

Project Introductions: 5 min

The project introduction is an opportunity to present your preliminary work and your proposed solution to the client and your peers. Like the proposal it is very short. Attendance is mandatory, and all group members should participate , although this requirement is flexible because of the brevity of the presentation.

Midterm Report

The progress report should be the largest and the most technically-focused of the project reports. It should describe the project in detail including what work has been done and what remains. The report should address questions such as how systems will be modeled, what software will be used, what characteristics will be optimized and how the benefit of the system will be evaluated. It must include:

1. Executive summary (Layman's abstract)
2. Technical summary
3. Project description
   a) Motivation
   b) Objectives / Scope
4. Technical Progress Report
   a) A detailed explanation of the analytical methods to be used
   b) A progress report including the results of preliminary analyses
   c) An updated work schedule showing the completed and outstanding tasks
5. Budget Report
   a) Tables showing whether the consultancy budget is on target.
   b) An updated implementation budget
6. Concerns or issues that have arisen, and proposed actions
7. Conclusion

Project Presentation: 15 min

The project presentation is an opportunity to show the client what work has been done and how the rest of the project will unfold. It should clearly present the project objectives and scope and describe the technical methods that are being used in as much detail as possible. Consultancy and project budgets should be reviewed and revised where necessary. Any preliminary results should be presented. Everyone in the group will take part in the presentation.

Attendance to presentations, and also staying in class until all the presentations completed, is compulsory.

Final Report:

The final report documents the project and its findings. While less technically focused than the midterm report, it should clearly describe the design process and provide a detailed technical description of any analysis not previously described. The final report does not need to repeat the material covered in the midterm report, but the two reports together must completely document the project. The final report should focus primarily on the project schedule and budget, and on the project's value to the client.

1) Executive and technical summaries
2) Technical Report
   a) Overview of the methods used
   b) Detailed description of methods not already described in the Progress Report
   c) Key design decisions
   d) Technical conclusions and outstanding issues
3) Budget Report
   a) Budget tables for the design and implementation
   b) Work schedule sheet showing the completed tasks
4) Concerns or issues that arose
5) Conclusions
6) Recommendations