

SYLLABUS ASTE555 (3 UNITS)
Space Cryogenic Systems
and Applications
Mondays 5:10 – 7:50 PM AT USC
Spring 2018

Course Instructor: Dr. Sidney W. Yuan
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Course website: TBD

COURSE SCOPE AND OBJECTIVES:

This course introduces students to a broad view of various sensor cooling techniques used in the aerospace industry, ranging from the conventional radiative cooling to the use of superfluid as cryogen and superconductor to detect x-rays. Students will be introduced to the special theory of superfluidity with zero viscosity to flow, and that of superconductivity without electrical resistance. Various techniques like cryoradiators, cryogen cryostats and mechanical cryocoolers will be discussed. The course also includes two demonstrations, with one on mechanical cryocooler and the other one on superconductor.

COURSE FORMAT:

Dates: Class meets on Fridays, 5:10 to 7:50 pm
Location: [TBD]

PREREQUISITES:

Graduate standing in engineering

COURSE GRADING:

Homework:	30%
Mid-term Exam:	30%
Final Exam:	40%

TEXTS

- 1) Spacecraft Thermal Control Handbook, Vol II: Cryogenics, Martin Donabedian, AIAA Press, 2003.
- 2) Lecture Notes

Course Schedule

	Topics/Daily	Readings
Week 1	Introduction	Text- Page 1 to 6 Lecture Notes
Week 2	Stored Expendable System- Fluid Cryogen Systems / Superfluidity	Text- Page 13 to 28 Lecture Notes
Week 3	Stored Expendable System- Solid Cryogenes and Open Cycle JT	Text- Page 31 to 51 Lecture Notes
Week 4	Cryoradiators	Text- Page 55 to 116 Lecture Notes
Week 5	Cryocoolers- Regenerative Systems	Text- Page 135 to 172 Lecture Notes
Week 6	Cryocoolers- Recuperative Systems	Text- Page 175 to 185 Lecture Notes
Week 7	Cryocoolers- Closed JT Systems	Text- Page 187 to 213 Lecture Notes
Week 8	Mid-Term Exam	
Week 9	Cryocoolers- Performance, Reliability & Integration	Text- Page 217 to 323 Lecture Notes
Week 10	Cryogenic Components 1	Text- Page 327 to 370 Lecture Notes
Week 11	Cryogenic Components 2	Text- Page 371 to 465 Lecture Notes
Week 12	Analyses / Thermal Margin	Text- Page 469 to 545 Lecture Notes
Week 13	Cryogenic Properties	Text- Page 549 to 603 Lecture Notes
Week 14	Safety / Superconductivity	Lecture Notes
Week 15	Final	

Statement for Students with Disabilities

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. Website and contact information for DSP: http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html, (213) 740-0776 (Phone), (213) 740-6948 (TDD only), (213) 740-8216 (FAX) ability@usc.edu.

Statement on Academic Integrity

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. *SCampus*, the Student Guidebook, (www.usc.edu/scampus or <http://scampus.usc.edu>) contains the University Student Conduct Code (see University Governance, Section 11.00), while the recommended sanctions are located in Appendix A.

Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: <http://www.usc.edu/student-affairs/SJACS/>. Information on intellectual property at USC is available at: <http://usc.edu/academe/acsen/issues/ipr/index.html>.

Emergency Preparedness/Course Continuity in a Crisis

In case of a declared emergency if travel to campus is not feasible, USC executive leadership will announce an electronic way for instructors to teach students in their residence halls or homes using a combination of Blackboard, teleconferencing, and other technologies.

Please activate your course in Blackboard with access to the course syllabus. Whether or not you use Blackboard regularly, these preparations will be crucial in an emergency. USC's Blackboard learning management system and support information is available at blackboard.usc.edu.