MEC 305 (Heat and Mass Transfer)
Spring 2019

Course Administration

INSTRUCTOR:	GunWoong Bahng, C622 Academic Building, (032) 622 1222 E-mail: gwbahng@sunykorea.ac.kr
TEACHING ASSISTANT	Andreas Jacobs (MEC Major) jacobs.somnic@stonybrook.edu TA office hours :TBD
LECTURE HOURS:	Mon and Wed (3:30 pm - 4:50 pm), A116 Recitation, Wed (5:00 pm – 5:50 pm), A116
OFFICE HOURS:	Tuesday and Thursday (5:00 pm - 6:30 pm) or by appointment.
REQUIRED TEXTS:	Yunus Cengel and Afshin Ghajar, *Heat and Mass Transfer: Fundamentals & Applications*, 5th Ed., McGraw-Hill, 2015
PREREQUISITES:	MEC 301 and 364; MEC 102 or ESG 111 or ESE 124 or CSE 114 or CSE 130 or BME 120
HOMEWORK:	Homework to be assigned either weekly or biweekly. Assignments will be due by the end of class a week after they are assigned, unless otherwise stated. Late homework will receive half credit until the solutions are posted and will not be accepted after that.
EXAMS:	2 Midterms (dates TBD) 1 Final Exam (Final exam week, June 12 – June 18) • Midterm exams will be scheduled in class. • No makeup exam unless arranged prior to the exam.
GRADING:	Semester grade is based upon your performance in the following categories.

Homework	20%
Two Midterms	40%
Final with Competency Questions	35%
Attendance	5 %

GRADING SCALE Grading on the Curve:

COURSE TOPICS	1. Basic Concepts of Thermodynamics and Heat Transfer 2. Heat Conduction 3. Heat Conduction Equation 4. Steady Heat Conduction 5. Transient Heat Conduction 6. Convection 7. Fundamentals of Convection 8. Forced Convection 9. Natural Convection 10. Radiation Heat Transfer

COURSE LEARNING OBJECTIVES	**PIs**	**ASSESSMENT TOOLS**
1. Demonstrate the ability to identify the three modes of heat transfer: conduction, convection, and radiation, and solve simple multi-mode heat transfer problem.	a3, e1	Competency Questions
2. Demonstrate the ability to formulate and solve the differential equation of heat conduction in various coordinates systems with proper thermal boundary conditions.	a3	Competency Questions
3. Demonstrate the ability to develop thermal resistance networks for practical heat conduction problems.	a3	Competency Questions
4. Demonstrate the ability to solve transient lumped-parameter heat conduction problems.	a3	Competency Questions
5. Demonstrate the ability to analyze convective heat transfer in boundary layer and internal pipe flows based on Newton's law of cooling.	b3, e2, j1	Competency Questions
6. Demonstrate the ability to analyze radiative heat transfer between nonblack surfaces.	a3, e2, j2	Competency Questions

COGNITIVE DEVELOPMENT	a	b	c	d	e	f	g	h	i	j	k
	2	1			2/1/-					1	
	1 – Knowledge/Comprehension, 2 – Application/Analysis, 3 – Synthesis/Evaluation										

Course Overview

The fundamental laws of momentum, heat and mass transfer, and the corresponding transport coefficients. Principles of steady-state and transient heat conduction in solids are investigated. Laminar and turbulent boundary layer flows are treated, as well as thermal radiation, and radiation heat transfer between surfaces. Applications to heat transfer equipment are covered throughout the course.

Tentative Schedule

WEEK	MATERIAL COVERED	Text Chapters

1	Introduction and Basic Concepts Thermodynamics and heat transfer, Conduction, Convection, Radiation.	Ch.1
2	Heat conduction equation One dimensional heat conduction equation, Boundary and initial condition, Heat generation in a solid, variable thermal conductivity	Ch.2
3	Steady heat conduction Steady heat conduction in plane walls, Thermal contact resistance, Generalized thermal resistance networks, Heat conduction in cylinders and spheres, critical radius of insulation.	Ch. 3
4	Steady heat conduction Heat transfer from finned surface, Bioheat transfer equation, heat transfer in common configuration.	Ch. 3
5	Transient heat conduction Lumped system analysis, Transient heat conduction in large plane walls, long cylinders, and spheres with spatial effects.	Ch.4
6	Transient heat conduction Transient heat conduction in semi-infinite solids, Transient heat conduction in multidimensional systems.	Ch. 4

Midterm Exam 1 (Chs. 1, 2, 3 and 4): To be announced at the class.

7	Fundamentals of convection Physical mechanism of convection, velocity of boundary layer, thermal boundary layer, laminar and turbulent flows, heat and momentum transfer in turbulent flow.	Ch. 6
8	Fundamentals of convection Derivation of differential convection equations, solutions of convection equations for a flat plate, nondimentionalized convection equations and similarity, functional forms of friction and convection coefficients, analogies between momentum and heat rransfer.	Ch. 6
9	External forced convection Drag and heat transfer in external flow, parallel flow over flat plates, flow across cylinders and spheres, flow across tube banks.	Ch.7
10	Natural convection Physical mechanism of natural convection, equation of motion and the Grashof number, natural convection over surfaces, natural convection from finned surfaces and PCBs.	Ch.9
11	Natural convection Natural convection inside enclosures, combined natural and forced convection.	Ch.9

Midterm Exam 2 (Ch.6, 7, and 9): To be announced at the class.

12	Fundamentals of thermal radiation	Ch.12

Thermal radiation, blackbody radiation, radiation intensity, radiative properties, atmospheric and solar radiation.

13	Radiation heat transfer View factor, view factor radiation, radiation heat transfer, black surfaces.	Ch.13
14	Eradiation heat transfer Radiation heat transfer, diffuse, gray surfaces, radiation shields and the radiation effects, radiation exchange with emitting and absorbing gases.	Ch.13

Final Exam (comprehensive): Final Exam week, June 12 (Wed) – June 18 (Tue)

BLACKBOARD: All homework assignments and solutions will be posted on the Blackboard course account (http://blackboard.stonybrook.edu/.). For problems logging in, go to the coordinator of the department.

I use email and blackboard exclusively to communicate with you off class. It is your responsibility to make sure that you can access the blackboard system.

ACADEMIC HONESTY: The campus policies on academic honesty are available on the Web (http://naples.cc.sunysb.edu/CAS/ajc.nsf/pages/info).
Academic dishonesty is an extremely serious offense and will not be tolerated in any form. Academic dishonesty in general is the presentation of intellectual work that is not originally yours. Examples include, *but are not limited to*, copying or plagiarizing class assignments including homework, reports, and other submitted materials; copying or otherwise communicating answers on exams with other students; bringing unapproved aids, either in physical (written) or electronic form to an exam; obtaining copies of an exam prior to its administration, etc. Academic dishonesty violates both the ethical and moral standards of the Engineering profession and all infractions related to academic dishonesty will be prosecuted.
Faculty members are required to report any suspected instances of academic dishonesty to the Academic Judiciary. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website: http://www.stonybrook.edu/commcms/academic_integrity/index.html

SPECIAL NOTE ON ADA: If you have a physical, psychological, medical or learning disability that may impact your course work, please contact One-Stop Service Center, Academic Building A201, (82) 32-626-1117. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential.

CRITICAL INCIDENT MANAGEMENT STATEMENT:
The State University of New York, Korea expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that

interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn.

ATTENDANCE POLICY of SUNY Korea:

1. All students of SUNY Korea are required to attend every class.
2. Unexcused absences will affect seriously the student's final grade in the course.
3. If a student has over 20% unexcused absence, the student's final course grade will be an 'F'.
4. Students should report the reason of absence to the instructor in advance, or immediately after the absence.
5. When a student excuses his/her absence, the student must provide documentation of the reason for the absence to the instructor.
6. The instructor of the course reserves the right to excuse absences.
7. The course instructor may excuse the absence if the submitted documentation fulfills the conditions below. • Extreme emergencies (e.g. death in the family) • Severe medical reasons with doctor's note (Not a slight illness) • Very important events (e.g. national conference, official school event)
8. At the end of semester, the course instructor should submit a copy of the attendance sheet to the Academic Affairs Office.