

MEC 320: Numerical Methods in Engineering Design and Analysis
The State University of New York Korea – Stony Brook University, Fall 2022

INSTRUCTOR	Dr. Jongseong Choi	jongseong.choi@sunykorea.ac.kr	Academic Building B625
TA	Jonathan Boyack	jonathan.boyack@stonybrook.edu	-
CLASSES	MW	2:00 – 3:20 pm	A114
OFFICE HOURS	M	3:30 – 5:30 pm, or by appointment	B625

COURSE TEXTBOOK

Numerical Methods for Engineers, Chapra S. C., Canale. R. P., McGraw-Hill Education, 8 ed., 2020.

ASSIGNMENTS

As basic preparation for each lecture, you should read the assigned material before coming to class. In-class discussion and examples are designed to help prepare you for homework assignments. In addition to the reading and homework assignments, you should review your past class notes on a daily basis.

Homework: Individual homework is assigned weekly throughout the semester. They will be given every Monday. Homework assignment should be scanned and submitted through Blackboard (<https://blackboard.stonybrook.edu/>) before Monday at 11:59 pm of the following week. You can drop one worst score at the end of the course. The detailed course schedule is provided in the following pages of ‘**Course Schedule**’.

CODING SESSION

Coding sessions are implemented seven times during the semester. Please **bring your own laptop** for the direct interaction and implementation in the session. The instructor encourages using Python throughout the course as the sessions run with Python examples. The detailed coding session schedule is provided in the following pages of ‘**Course schedule**’ as with red-colored.

EXAMINATION

There are one midterm examination and one comprehensive final examination. Those are take-home exams with 7 days’ duration. Each student needs to submit a **formal report format; Introduction, Analysis, Result, Discussion, Reference, Appendix, and electronic script files**. Please compress as one file with your information “Lastname_Firstname_ID”.

COURSE GRADING

Homework & Attendance	25% & 5%
Midterm	30%
Final Exam	40%
TOTAL	100%

Grading will be curved and normalized to 100% then given in a scale of:

92 ≤ A < 100	74 ≤ C+ < 78
88 ≤ A- < 92	70 ≤ C < 74
85 ≤ B+ < 88	67 ≤ C- < 70
81 ≤ B < 85	64 ≤ D+ < 67
78 ≤ B- < 81	60 ≤ D < 64

SAFETY GUIDELINE

Everyone participating in any in-person sessions or meetings **must wear a mask or face covering at all times** or have the appropriate documentation for medical exemption. Any student not in compliance with this policy will be asked to leave the classroom. If students need to drink or eat, they should step out of the classroom to do so.

COURSE LEARNING OBJECTIVES	ASSESSMENT TOOL
1. Be able to numerically find roots of nonlinear scalar equations	Exams/ Homework
2. Be able to numerically solve systems of linear algebraic eqns.	Exams/ Homework
3. Be able to interpolate and extrapolate a data set	Exams/ Homework
4. Be able to differentiate and integrate numerically	Exams/ Homework
5. Be able to pose and understand the nature of an optimal design problem	Exams/ Homework
6. Be able to solve un- and constrained optimization problems numerically.	Exams/ Homework
7. Be able to find numerical solutions of two-point BVP's	Exams/ Homework
8. Be able to find numerical integrations of ODE IVP's	Exams/ Homework
9. Be able to use methods of curve fitting	Exams/ Homework

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. 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

PROBLEM SOLUTION FORMAT

For both homework and examination, use empty A4-size paper, only one side and only one problem per page. If more than one page is needed for a problem, all pages must be transmitted in order. At the top of the paper, you write the following information from left:

Your name (first, last)	Student ID number	Problem number (i.e. HW1, HW2, ...)	Page number (i.e. 1/3, 2/3, 3/3, ...)
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Then, provide the information listed below:

Find: List what the problem wants you to find. You use this information to decide on the system you'll be analyzing, and how you'll sketch the appropriate energy flow diagram. This information will also drive your choice of basic equation(s) for problem solution since the one(s) you chose must include the quantity (or quantities) of interest.

Energy Flow Diagram (EFD): Your Energy Flow Diagram (EFD) will identify your system boundary, indicate where energy and mass flow into/out of your system, and which forms these flows take. Your EFD will guide your choice of terms in the basic equations that you keep or reject.

Given: Given information serves three purposes. First, it helps you determine which terms in your basic equations you can settle on immediately. Second, it helps you determine how many basic equations you need—the number of basic equations must equal the number of unknowns. Third, it provides guidance for constructing your EFD.

Assumptions: Assumptions are listed to help you eliminate terms in your basic equations. e.g. "Steady state," "Uniform flow," "Ideal gas," etc.

Solution: This includes correct units.

Course Schedule, MEC 320: Numerical Methods in Engineering Design and Analysis,
The State University of New York Korea – Stony Brook University, Fall 2022

Lecture	Day	Date	Location	Topic	PART	HW given	HW due
1	M	Aug 29	A114	Syllabus, Intro, Basic Concept, Motivation	1		
2	W	Aug 31	A114	Significant Figures, Types of Error, Computer Arithmetic	1		
3	M	Sep 5	A114	Finding real roots of nonlinear equations	2	HW#1	
4	W	Sep 7	A114	Coding session: Settings, Installations, Anaconda, etc			
	M	Sep 12	A114	Chuseok holiday - No class		HW#2	HW#1
5	W	Sep 14	A114	Coding session: Basic Python comments, HW#1 review			
6	M	Sep 19	A114	Gauss Elimination	3	HW#3	HW#2
7	W	Sep 21	A114	LU Decomposition and Matrix Inversion	3		
8	M	Sep 26	A114	Correction day – Gauss Elimination	3	HW#4	HW#3
9	W	Sep 28	A114	Coding session: HW#2 & 3 review			
	M	Oct 3	A114	Substitute of Korea National Foundation Day – No class		HW#5	HW#4
10	T	Oct 4	A114	Correction day – LU Decomposition			
11	W	Oct 5	A114	Matrix Inverse	3		
	M	Oct 10	A114	Substitute of Hangul Day – No class			HW#5
12	W	Oct 12	A114	Coding session: HW#4 & 5 review			
13	M	Oct 17	A114	Practice for Midterm #1			
	W	Oct 19	A114	Midterm #1 – No class			
14	M	Oct 24	A114	Review Midterm #1;		HW#6	
15	W	Oct 26	A114	One-Dimensional Unconstrained Optimization	4		
16	M	Oct 31	A114	Multidimensional Unconstrained Optimization	4	HW#7	HW#6
17	W	Nov 2	A114	Least-Squares Regression	5		
18	M	Nov 7	A114	Interpolation	5	HW#8	HW#7
	W	Nov 9	A114	Prof. Choi's business trip absence – No class; makeup lecture will be given.			
19	M	Nov 14	A114	ODE: Runge-Kutta Methods		HW#9	HW#8
20	W	Nov 16	A114	Coding session: HW#6 & 7 review	7		
21	M	Nov 21	A114	ODE: Boundary-value and eigenvalue problems	7		HW#9
22	W	Nov 23	A114	Coding session: HW#8 & 9 review			
23	M	Nov 28	A114	PDE: Finite Difference and Finite Element Methods	8	HW#10	
24	W	Nov 30	A114	PDE: Finite Difference and Finite Element Methods	8		
25	M	Dec 5	A114	Coding session: HW#10 review	8		HW#10
26	W	Dec 7	A114	Correction day – substitution for the class on Nov 9; Practice for Final Exam			
	W	TBD	TBD	Final Examination			