MEC 226 Modern Machining Practices
Spring 2019

Instructor: Noah D. Machtay, Ph.D., P.E., 146 Heavy Engineering Building, 2-9014
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Office Hours: MWF 8:30-9:30AM, HE146
Monday Lab Session: 2-4PM, HE137
Wednesday Lab Session: 2-4PM, HE137

Course Objectives: Hands-on lab-based experience with modern automated machining practices including additive (Fused Deposition Modeling - FDM - rapid prototyping) and subtractive (Computer Numerical Control - CNC – multi-axis machining) processes. This course has an associated fee. Please see www.stonybrook.edu/coursefees for more information. Prerequisite: MEC major
Pre- or Co-requisite: MEC 203, Cannot be taken for credit with MEC225

Attendance policy: Lab sessions are absolutely mandatory. Students who are late for or miss a lab session will receive a grade of zero for that lab session. Students who report to the lab in inappropriate attire will not be permitted to enter, and will be marked as absent, with all relevant grading penalties.

Safety: At the sole discretion of the instructor, any student may be removed from the laboratory for any unsafe conduct, at any time, and for any duration. At the sole discretion of the instructor, these students may be barred from returning to the lab for any duration. Affected students will receive grades of zero for all missed lab work, up to and including the complete course grade. Your safety is our top priority, and as such, this policy is not negotiable. Using university equipment and/or facilities to create or attempt to create weapons or other items with significant injurious capacity will result in instant failure of the course, and a permanent and irrevocable ban from the laboratory, at the instructor's sole discretion.

Required Materials: Required materials for the lab will be provided from the course lab fee.

Lab work: Students will form into lab groups consisting of 3 students. The lab groups will be further subdivided into Regiments A and B. Lab groups are responsible for conducting experiments and design work as instructed. It is each student's responsibility to ensure that the group functions well and achieves the assigned goals. Students found to be making insufficient contributions to their group's work will be removed from the group, and will receive a grade of zero for all lab work, at the sole discretion of the instructor.

> **Lab Roles:** Each lab experiment has 3 roles: the draftsperson who completes the mechanical drawing of the part using proper geometric dimensioning and tolerancing standards, the machinist who completes the machine operations to fabricate the part as designed, and the inspector who is responsible for using proper metrology techniques to measure the finished part and for reporting on compliance and/or deviations from the dimensions of the original drawing. Each student ***MUST*** perform each role at least once over the course of the 4 laboratory experiments, or else a grade of zero will be assigned for the course.
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> **Lab Grading:** Each student is responsible for the drawing the group produces, the part the group produces, and the inspection that the group performs for each lab. Instructors will also grade the accuracy of the part manufactured by the group. All students in a group will receive the same grade, unless differential grading is deemed appropriate by the instructor, in which case the student(s) failing to contribute adequately will receive a grade of zero instead. Refer to the lab grading rubric for details. Late submissions will receive a grade of zero.

Grading: *20% Basic RP Project, 20% Basic CNC Project, 20% Advanced RP Project, 20% Advanced CNC Project, 20% Safe Participation*

Cell phone and electronic device policy: Cellular phones or other communication devices are not permitted in the lab. Audio or video recording or photography during class is strictly prohibited, and anyone found in violation will be ejected from the course with a failing grade. Students may not use personal electronic devices during lab sessions – this includes but is not limited to cell phones, laptop computers, cameras, music devices, etc.

Excused absences for religious observance and severe illness: From the university policy statement regarding religious holidays, students will be expected to notify their professor in advance, but definitely before the final date of the 'add/drop' period of their intention to be out for religious observance. Notification of intention to be out for a religious holiday MUST be made through the CEAS Undergraduate office, who will verify and evaluate the notification, and provide the instructor with appropriate instructions; you must include your name, SBID#, and the course number when contacting CEAS in regards to your absence. Requests for an excused absence for severe illness must be made through CEAS in the same manner.

Statement on Academic Dishonesty

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, designs, 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 to the fullest via the CEAS CASA committee. For you, the honest student, academic dishonesty results in lower class curves, hence a depression in your GPA and class standing, while cheapening the degree you earn. Please note that failing to provide proper citations in a paper or report constitutes plagiarism and will be prosecuted accordingly. Be sure to cite your sources![1]

Allowed Calculators

For both security and uniformity in this class **only** the following calculators will be allowed. There will be no exceptions. This list of calculators is identical to that allowed for the *National Council for Examiners for Engineering and Surveying* (NCEES) Fundamentals of Engineering (FE) exam, as well as the Professional Engineering (PE) exam

Casio:	All fx-115 models. Any Casio calculator must contain fx-115 in its model name.
Hewlett Packard:	The HP 33s and HP 35s models, but no others.
Texas Instruments:	All TI-30X and TI-36X models. Any Texas Instruments calculator must contain either TI-30X or TI-36X in its model name.

Course Learning Objectives
1) Understand and develop the habit of following all safety rules
2) Ability to use basic metrology tools
3) Ability to operate Rapid Prototyping (RP) equipment from an existing solid model
4) Ability to operate Computer Numerical Control (CNC) equipment using G, M, and T-Code
5) Ability to operate Rapid Prototyping (RP) equipment to produce self-designed parts
6) Ability to operate Computer Numerical Control (CNC) equipment using Computer Aided Manufacturing (CAM) software

Grading Policy:

Undergraduate:	
100-95 = A	79-77 = C+
94-90 = A-	76-74 = C
89-87 = B+	73-70 = C-
86-84 = B	69-65 = D+
83-80 = B-	64-60 = D
	<60 = F

Note: All grades are TRUNCATED, not rounded.

[1] Dr. Jon Longtin, Department of Mechanical Engineering, Stony Brook University

Approximate Course Schedule:

Week 1.	Safety instruction, Project and design work overview, Introduction to tools and equipment, Introduction to G-Code, M-Code, T-Code machine control programming, Introduction to basic CAM software operation for Rapid Prototyping
Week 2.	CNC control with G-Code, M-Code, T-Code, and basic tooling/speeds and feeds Basic Rapid Prototyping operation
Week 3.	Review of mechanical drawing standards, introduction to basic metrology Regiment A: Basic FDM Rapid Prototyping Project Session 1 Regiment B: Basic CNC Machining Project Session 1
Week 4.	Review of basic metrology Regiment A: Basic FDM Rapid Prototyping Project Session 2 Regiment B: Basic CNC Machining Project Session 2
Week 5.	Regiment A: Basic FDM Rapid Prototyping Project Session 3, Project Due Regiment B: Basic CNC Machining Project Session 3, Project Due
Week 6.	Introduction to CAM software operation for CNC Machining Regiment A: Basic CNC Machining Project Session 1 Regiment B: Basic FDM Rapid Prototyping Project Session 1
Week 7.	Review of CAM software operation for CNC Machining Regiment A: Basic CNC Machining Project Session 2 Regiment B: Basic FDM Rapid Prototyping Project Session 2
Week 8.	Regiment A: Basic CNC Machining Project Session 3, Project Due Regiment B: Basic FDM Rapid Prototyping Project Session 3, Project Due
Week 9.	Regiment A: Advanced FDM Rapid Prototyping Project Session 1 Regiment B: Advanced CNC Machining Project Session 1
Week 10.	Regiment A: Advanced FDM Rapid Prototyping Project Session 2 Regiment B: Advanced CNC Machining Project Session 2
Week 11.	Regiment A: Advanced FDM Rapid Prototyping Project Session 3, Project Due Regiment B: Advanced CNC Machining Project Session 3, Project Due
Week 12.	Regiment A: Advanced CNC Machining Project Session 1 Regiment B: Advanced FDM Rapid Prototyping Project Session 1
Week 13	Regiment A: Advanced CNC Machining Project Session 2 Regiment B: Advanced FDM Rapid Prototyping Project Session 2
Week 14	Regiment A: Advanced CNC Machining Project Session 3, Project Due Regiment B: Advanced FDM Rapid Prototyping Project Session 3, Project Due

University required statements:

"STUDENT ACCESSIBILITY SUPPORT CENTER (SACS) STATEMENT (must be the following language)
If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact the Student Accessibility Support Center, 128 ECC Building, (631) 632-6748, or at sasc@Stonybrook.edu. They will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential. Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and the Student Accessibility Support Center. For procedures and information go to the following website: https://ehs.stonybrook.edu/programs/fire-safety/emergency-evacuation/evacuation-guide-people-physical-disabilities and search Fire Safety and Evacuation and Disabilities.

ACADEMIC INTEGRITY STATEMENT (must be the following language as approved by the undergrad council):
Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty are required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at http://www.stonybrook.edu/uaa/academicjudiciary/

CRITICAL INCIDENT MANAGEMENT (must be the following language as approved by the undergrad council):
Stony Brook University 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. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures."

Laboratory Project Summary:

Basic FDM Rapid Prototyping Project: Utilizing an existing solid model, students will produce a properly dimensioned and toleranced mechanical drawing, manufacture the part using FDM Rapid Prototyping equipment in the laboratory, and inspect the mechanical dimensions of the finished part against the original drawing to determine whether the part is within tolerances or not. Each project must be approved by the course instructor.

Basic CNC Machining Project: Students will design a 2D pattern to be machined into the available workpiece; the pattern must include both straight lines and arcs. They will then produce a fully dimensioned and toleranced mechanical drawing of the part, manufacture the part using the CNC equipment in the lab which they will program without the aid of CAM software (writing G-code, M-code, T-code by hand), and inspect the mechanical dimensions of the finished part against the original drawing to determine whether the part is within tolerances or not. Each project must be approved by the course instructor.

Advanced FDM Rapid Prototyping Project: Students will design a three dimensional object which must mechanically integrate with the part produced during the Advanced CNC Machining project. Students will produce a properly dimensioned and toleranced mechanical drawing, manufacture the part using FDM Rapid Prototyping equipment in the laboratory, and inspect the mechanical dimensions of the finished part against the original drawing to determine whether the part is within tolerances or not. Each project must be approved by the course instructor.

Advanced CNC Machining Project: Students will design a three dimensional pattern to be machined into the available workpiece; the finished part must integrate with the part produced during the Advanced FDM Rapid Prototyping project. They will then produce a fully dimensioned and toleranced mechanical drawing of the part, manufacture the part using the CNC equipment in the lab which they will program using CAM software, and inspect the mechanical dimensions of the finished part against the original drawing to determine whether the part is within tolerances or not. Each project must be approved by the course instructor.