

MEC ENG 102B  
**Mechatronics Design**  
Fall 2020 (4 units)

**Course Objectives:**

This class introduces students to design techniques for mechatronics systems; provides guidelines to and experience with design of variety of actuators; provides experience in programming microcomputers for smart products; exposes students to the synthesis of mechanical power transfer components; develops an understanding of dynamics and kinematics in robotic systems; exposes students to design experiences in synthesis of feedback systems; provides experience prototyping mechatronics devices collaboratively.

**Prerequisites:**

E 25/26/27 (junior transfers students are exempt from this requirement), as well as EE 16A or EE 40

**Communications:**

We will be using bCourses for the course website: <https://bcourses.berkeley.edu/>.

Sign up for Piazza using this link: [piazza.com/berkeley/fall2020/mec102b](https://piazza.com/berkeley/fall2020/mec102b).

All technical and general questions should be asked in office hours or on Piazza discussion boards.

**Instructors:**

Professor Hannah Stuart

Office Hours: Monday & Tuesday 1:15-2:00p  
at <https://berkeley.zoom.us/j/92793603033>

Professor Homayoon Kazerooni

Office Hours: Wednesday 10:00-11:30a  
at <https://berkeley.zoom.us/j/9102888246>

GSI, Joseph Skelley

Office Hours: Tuesday 4p-6p, Friday 11a-3p  
at <https://berkeley.zoom.us/j/92566341780>

Kit & Firmware support staff, Tom Clark

Cell: 510-435-0357, [tomclark@berkeley.edu](mailto:tomclark@berkeley.edu)

**SCHEDULE AND LOGISTICS:**

This class is listed as “Hybrid” so some components might be offered in-person (pending a decision by the campus). Regardless, students have the choice to take the course fully-remotely.

**Lectures:** <https://berkeley.zoom.us/j/98031944049> Passcode: machines

Only UC Berkeley authenticated users can join (i.e. you must use your Berkeley email address).

**MW 9:10a-10a** Lectures

**M 10:10a-11a** Supplemental lessons / Recitation

All lessons will be hosted synchronously and asynchronously. i.e. we will lecture live, then post a recording of the lecture onto the bcourses “Media Gallery.”

**Lab sections: M 11a-2p, M 2p-5p, Tu 11a-2p**

It is possible to perform all assignments asynchronously. However, you are encouraged to work with classmates to facilitate collaboration. No dedicated class zoom link is provided.

**Course Materials:** Lecture slides/notes will be provided. Text purchases are recommended (optional):

- C.R. Mischke and J.E. Shigley, “Mechanical Engineering Design,” 11th edition.
- Carryer, Ohline and Kenny, “Introduction to Mechatronic Design.”

A lab kit will enable you to perform hands-on assignments at home. There will be no fee associated with the kit this year. You may be responsible for replacing parts that break as a result of misuse. More information about the lab kit can be found at <https://microkit.berkeley.edu/>.

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You will be required to use the Arduino IDE as well as MATLAB and a CAD software package. You must download software to your personal computer. See <https://software.berkeley.edu/home> for more information. If you are unable to do so, notify the teaching team within the first 2 weeks of class.

**Scoring:**

This semester, we are largely basing assessment on a series of new assignments/labs. Some of them have hands-on components, like a laboratory at home.

- 10%** Assignment 1: Finite State Machines
- 10%** Assignment 2: DC motor characteristics and selection
- 10%** Assignment 3: Transistors and integrated systems
- 10%** Assignment 4: Driving a DC motor
- 15%** Assignment 5/6: Feedback control implementation / Comparing actuation modalities
- 15%** Assignment 7/8: Shafts and Bearings / Transmissions Calculations

You will not be asked to perform a semester-long design project as in the past. Instead, we will end the semester with a 3+ week long mini-project. The details of this project will be published later on.

- 30%** Mini-project: Putting it all together

We will not curve grades, as this practice reinforces inequity.

**Academic Honesty and Integrity:**

The student community at UC Berkeley has adopted the following Honor Code: "As a member of the UC Berkeley community, I act with honesty, integrity, and respect for others." For all assignments in this class, you are allowed (and encouraged!) to discuss the problems and techniques with other students currently in this course, but each student must do his or her own version of the solution *from scratch*. Do not send your solution files to other students, or post them online. Performing screen share via video call is acceptable during collaborative discussions. Cheating on assignments may result in a failing grade, depending on the severity. In all cases, your actions will be reported to the Center for Student Conduct.

**Late policy:**

All required files must be submitted online via bCourses by the deadline specified. Submit only the requested format (e.g., a single PDF). Your solutions can be hand-written (pen recommended) as long as they're legible once scanned. If your solutions are illegible, you may lose points on the assignment that cannot be made-up. Late assignments will have the graded score multiplied by a factor of 0.9 (24 hours late) or 0.8 (24 to 72 hours late). Any assignment may be submitted more than 72 hours after the original deadline time for 70% credit until 12/01/2020. No homework assignments will be accepted after this date.

**The mini-project cannot be submitted late.**

**Special accommodations:**

We honor and respect the different learning needs of our students, and are committed to ensuring you have the resources you need to succeed in our class. For foreseeable conflicts with the class, notify the teaching staff within the first 2 weeks of class to discuss potential accommodations. Please notify us of unexpected and overlooked issues that arise at any time throughout the semester.

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**WEEKLY AGENDA (tentative):**

Week	Monday 9a-10a	Monday 10a-11a	Wednesday 9a-10a	Assignment/Lab Schedule
<b>Week 1</b> 8/24	No class	No class	Introduction <sup>S/K</sup>	--
<b>Week 2</b> 8/31	Finite State Machines <sup>S</sup>	Finite State Machines <sup>S</sup>	PM DC Motors <sup>K</sup>	--
<b>Week 3</b> 9/7	No class	No class	PM DC Motors <sup>K</sup>	--
<b>Week 4</b> 9/14	PM DC Motors <sup>K</sup>	Transistors <sup>K</sup>	H-Bridges <sup>K</sup>	Assignments 1 & 2: Due 9/20
<b>Week 5</b> 9/21	Transformers <sup>K</sup>	Induction Motors <sup>K</sup>	Micro-controllers <sup>K</sup>	--
<b>Week 6</b> 9/28	Micro-controllers <sup>K</sup>	Motor Feedback Control <sup>K</sup>	Op-amps and peripherals <sup>K</sup>	Assignment 3: Due 10/4
<b>Week 7</b> 10/5	Transmission Systems <sup>S</sup>	Transmission Systems <sup>S</sup>	Gears <sup>S</sup>	--
<b>Week 8</b> 10/12	Flexible Drives <sup>S</sup>	Ball Screws <sup>S</sup>	Planetary & Harmonic Gears <sup>K</sup>	Assignment 4: Due 10/18
<b>Week 9</b> 10/19	Bearings I <sup>S</sup>	Bearings II <sup>S</sup>	Linkages <sup>S</sup>	--
<b>Week 10</b> 10/26	Shaft Design <sup>S</sup>	Shaft Design <sup>S/K</sup>	Systems Design Considerations <sup>S</sup>	--
<b>Week 11</b> 11/2	Sensors <sup>K</sup>	Sensors <sup>K</sup>	Bearings III <sup>K</sup>	Assignment 5/6: Due 11/8
<b>Week 12</b> 11/9	Hydraulics <sup>K</sup>	Recitation <sup>S</sup>	No Class	--
<b>Week 13</b> 11/16	Clutches and Brakes <sup>K</sup>	Recitation <sup>S</sup>	Clutches and Brakes <sup>K</sup>	--
<b>Week 14</b> 11/23	Fasteners <sup>S</sup>	Recitation <sup>S</sup>	No Class	Assignment 7/8: Due 11/24 (Tuesday)
<b>Week 15</b> 11/30	Patent Basics <sup>K</sup>	Innovation in industry <sup>K</sup>	Ethics in Design <sup>S</sup>	--
<b>Week 16</b> 12/7	RRR	RRR	Jacobs showcase 12/9 @ 10a	Project report due 12/8 at noon Self-assessment due 12/11

<sup>K</sup> Prof. Kazerooni teaches

<sup>S</sup> Prof. Stuart teaches

This schedule is a guide and every attempt is made to provide an accurate overview of the course. However, circumstances and events may make it necessary for the instructors to modify the syllabus during the semester and may depend, in part, on the progress, needs, and experiences of the students. Changes to the syllabus will be made with notice to the students in the course.

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**Inclusion:** We are committed to creating a learning environment welcoming of all students that supports a diversity of thoughts, perspectives and experiences, and respects your identities and backgrounds (including race/ethnicity, nationality, gender identity, socioeconomic class, sexual orientation, language, religion, ability, etc.) To help accomplish this:

- If you have a name and/or set of pronouns that differ from those that appear in your official records, please let us know. Please make your Zoom profile reflect your preference.
- If you feel like your performance in the class is being impacted by your experiences outside of class (e.g., family matters, current events), please don't hesitate to come and talk with us.
- We (like many people) are still in the process of learning about diverse perspectives and identities. If something was said in class (by anyone) that made you feel uncomfortable, please talk to us about it. You may also contact the ME department's Vice Chair for Equity & Inclusion, Professor Grace O'Connell ([g.oconnell@berkeley.edu](mailto:g.oconnell@berkeley.edu)) or Staff Student Services for Equity and Inclusion, Ricky Vides ([rickyv72@berkeley.edu](mailto:rickyv72@berkeley.edu)). For ME specific resources for Equity & Inclusion please visit our website: <https://me.berkeley.edu/about/equity-and-inclusion/>
- As a participant in this class, recognize that you can be proactive about making other students feel included and respected.

## **OTHER RESOURCES**

**Center for Access to Engineering Excellence (CAEE)** The Center for Access to Engineering Excellence (227 Bechtel Engineering Center; <https://engineering.berkeley.edu/student-services/academic-support>) is an inclusive center that offers study spaces, tutoring in >50 courses for Berkeley engineers and other majors across campus, and a wide range of professional development, leadership, and wellness programs, and technology loans.

**Disabled Students' Program (DSP)** The Disabled Student's Program (260 César Chávez Student Center #4250; 510-642-0518; <http://dsp.berkeley.edu>) serves students with disabilities of all kinds. Services are individually designed and based on the specific needs of each student as identified by DSP's Specialists.

**Counseling and Psychological Services** The University Health Services Counseling and Psychological Services staff is located at the Tang Center (<http://uhs.berkeley.edu>; 2222 Bancroft Way; 642-9494) and provides confidential assistance to students managing mental health. To improve access for engineering students, a licensed psychologist from the Tang Center also holds walk-in appointments in 241 Bechtel Engineering Center (schedule: <https://engineering.berkeley.edu/student-services/advising-counseling>).

**The Care Line (PATH to Care Center)** The Care Line (510-643-2005; <https://care.berkeley.edu/care-line/>) is a 24/7, confidential, free, campus-based resource for urgent support around sexual assault, sexual harassment, interpersonal violence, stalking, and invasion of sexual privacy. The Care Line will connect you with a confidential advocate.

**Ombudsperson for Students** The Ombudsperson for Students (102 Sproul Hall; 642-5754; <http://students.berkeley.edu/Ombuds>) provides a confidential service for students involved in a University-related problem (academic or administrative), acting as a neutral complaint resolver and not as an advocate for any of the parties involved in a dispute.

**UC Berkeley Food Pantry** The UC Berkeley Food Pantry (#68 Martin Luther King Student Union; <https://pantry.berkeley.edu>) aims to reduce food insecurity among students and staff at UC Berkeley. The pantry operates on a self-assessed need basis; there are no eligibility requirements. The pantry is not for students and staff who need supplemental snacking food, but rather, core food support.