Available Projects for ME 195A/B – 2025-2026

Dear Students,

As the ME195A/B course coordinator, and on behalf of all four instructors, I am pleased to welcome you to ME195A in Fall 2025 and ME195B in Spring 2026. We look forward to working with you throughout this academic year.

To help you identify a great project and make the project selection process smoother, the ME195A instructors are sharing the available projects with you before the semester begins (see each section below to find out which projects are offered by each instructor).

Please note: Additional projects may become available or be finalized on the first day of class. We will meet from **1:30–2:45 pm in E189** on Wednesday, August 20, 2025 to review the course syllabus (an tentative version is attached) and go over the available projects.

After 2:45 pm, please meet with the instructor or industry partners whose projects interest you most. We are excited to see your ideas take shape and to support you in creating innovative, impactful designs this year.

Winncy Du

Professor
Mechanical Engineering Department.

Available Projects for ME 195A/B – 2025-2026

(Please contact the instructor for any final updates)

ME195A SECTION 01 BY PROF. RAGHU AGARWAL

Prof. Agarwal welcomes your creativity and initiative in selecting senior design projects. Instead of providing a pre-set list, projects will be accepted from proposals developed by students or sponsored by industry partners.

ME195A SECTION 02 BY PROF. AMIR ARMANI

#1: Electric Golf Ball Launching Machine

Objective: design and build an electric-powered golf ball launcher. An operator of the machine should be able to choose between an adjustable straight or curved trajectory to a specific target/area.

Target Audience: Undergraduate students in mechanical engineering or electrical engineering with an interest in robotics, mechatronics, and programming.

Challenge Overview: Students must design and build a working machine that can launch a golf ball in a straight or curved trajectory. The system must be fully electric and demonstrate tight dispersion for each shot.

Design Requirements:

- Fully Electric: The machine must be fully electric.
- Spin: The machine must be able to generate and properly spin the golf ball to allow for curved shots.
- Tight Dispersion: The system should be capable of accurately and precisely launching a golf ball to a predetermined target area within 2.5 yards from the center of line.

Evaluation Criteria:

- Functionality: Ability of the machine to launch the ball as specified in the design requirements.
- Tight Dispersion: Accuracy and precision in hitting a target/area, within 2.5 yards from the center of line.
- Innovation: Creativity and originality in the machine.
- Safety: Implementation of reasonable and effective safety measures.

For further questions, please contact Alex via email at alexcorrescruz@gmail.com, or through text/call via (831)643-5866.

#2 or more

Dr. Amir Armani currently has no additional specific projects for his section. Students are encouraged to propose their own project ideas.

ME195A SECTION 03 BY PROF. WINNCY DU

Note:

[1] Although seven projects are listed here, each section typically supports an average of five projects for approximately 25 students.

[2] Vista Robotics will sponsor either Project 2A or 2B, but not both.

[3] Prof. Winncy Du also welcomes student-proposed projects that are innovative and driven by individual interests.

#1: Pollutant Gas Propagation and Source Identification

Sponsor: Interlink Electronics | **Team Size:** 3–5 students
Focus Areas: Mechanical Design, Control, Data Acquisition, AI-Based Modeling, CFD Simulation and Analysis

Students will collaborate with Interlink Electronics to design and prototype an Air Quality Monitoring System that detects pollutants such as CO, SO_2, NOx, and O_3. While Interlink focuses on developing the gas sensor array nodes, students will design and build an indoor experimental chamber equipped with controlled gas valves, strategically placed sensor nodes, and a robust data acquisition system to study gas propagation patterns and identify pollutant sources. The project also includes developing gas propagation models using AI, CFD simulations, and predictive algorithms.

#2A: Robotic Interface for Peritoneal Dialysis Catheter

Sponsor: Vista Robotics | **Team Size:** 3–4 students
Focus Areas: Biomedical Robotics, Mechanical Design, FDA Design Controls

Students will work with Vista Robotics to design an ergonomic and efficient interface to connect a peritoneal dialysis catheter to an assistive robotic system. The interface must allow single-handed operation within 5 seconds for safe and efficient use by nephrologists. Students will follow FDA-compliant design processes from concept through prototyping, testing, and documentation. This is a key subcomponent of a larger medical robotics system being co-developed with a major dialysis provider in Asia.

#2B: Assembly Fixture for FDA-Cleared Handheld Surgical Tool

Sponsor: Vista Robotics | **Team Size:** 3–4 students
Focus Areas: Mechatronic Fixtures, Manufacturing Automation, Design for Assembly

Students will work with Vista Robotics to develop an advanced multi-function assembly fixture for a next-generation discectomy and endplate preparation device. The fixture must support tube cutting, laser welding, alignment tasks, and handle assembly. Students will participate in the entire design lifecycle, including prototyping and fabrication. This fixture will directly support production use by mid-2026, making it a unique opportunity to contribute to a real-world medical product soon to receive FDA clearance.

#3: Methane (CH_4) and Hydrogen (H_2) Monitoring for Optimal Anaerobic Digestion Performance

Sponsor: (A joint NSF proposal to be submitted in Oct., 2025) │ **Team Size:** 5 students (Potential collaborators: Georgia Tech, Stetter Consulting, etc.)
Focus Areas: Gas Sensing and Detection, Data Acquisition and Control systems, AI/ML-based Signal Processing

This project aims to develop a low-cost, real-time gas monitoring system to measure methane (CH_4) and hydrogen (H_2) concentrations during anaerobic digestion process. Instead of design from scratch, students could use commercially available sensors to build a sensor array with a circuit design (including a microcontroller, an interface), collect data at different rates and temperatures, to identify anaerobic conditions. Test mixtures will include 30–80% CH_4 and 0–20% H_2 in nitrogen as a makeup gas. Using AI/ML, the system is expected to analyze time- and temperature-dependent sensor signals to enhance sensitivity and selectivity, enabling deconvolution of CH_4 and H_2 concentrations in mixed gases.

#4: Autonomous Security Robot for Outdoor Patrol and Surveillance

Sponsor: TBD │ **Team Size:** 5-7 students
Focus Areas: Robotics and Mechatronics Design, Autonomous Navigation, Sensor Integration, AI/LLM-based Real-time Incident Detection

This project focuses on designing and prototyping an autonomous mobile security robot capable of patrolling outdoor environments to detect and prevent potential crimes. The system will assess security incidents in real time using multimodal sensors and onboard AI. Equipped with omni-directional wheels for full maneuverability, the robot will integrate LIDAR or ultrasonic sensors, high-resolution cameras, and SLAM algorithms to enable autonomous navigation, accurate mapping, and effective obstacle avoidance.

#5: Smart Modular Portable Living Unit with Remote Control

Sponsor: Will conduct fundraising │ **Team Size:** 5-7 students
Focus Areas: Structural Design and Materials Engineering, Modular and Portable Architecture, Space Optimization, Assembly/Disassembly Mechanisms, Smart Housing.

This project focuses on designing and prototyping a modular portable living unit that can be quickly assembled, disassembled, and transported on a standard truck. Built to comply with relevant building codes, it will provide a comfortable and functional space for temporary or mobile living. Features include a foldable bed, efficient interior layout, a window, door, and skylight for natural lighting. The design will utilize lightweight yet durable materials, modular panels, and secure quick-connect mechanisms to allow setup and breakdown by a small team. The unit will integrate electrical systems and smart home controls, enabling users to remotely operate lighting, AC/heater, and other onboard electronics via a smartphone app.

#6: RapidServe: Automated Hot-Food Vending Machine

Sponsor: Will conduct fundraising │ **Team Size:** 5 students
Focus Areas: Mechanical Design, Control, Thermal and Refrigerating Systems, Food-safe Materials, Sensors, and Automation, Human–machine Interface & Payment Integration

Design and prototype an automated hot-food vending machine capable of preparing and dispensing at least five distinct hot meals within 5–10 minutes. The system will store standardized food containers and ingredients, select a recipe based on user input, apply a rapid, food-safe heating method, and deliver the finished meal via a reliable retrieval mechanism. Key subsystems include a modular heating unit sized to fit standard containers, an automated ingredient/portioning module, a container handling and retrieval robot or conveyor, and a sealed hygiene system for safe storage and preparation. The machine will feature an intuitive touch-screen UI with menu selection and payment processing, plus embedded sensors for temperature, presence/level detection, and fault monitoring.

#7: Variable-Pressure Neck Chamber Collar Device

Co-supervisor: Prof. Areum Jensen (Dept. of Kinesiology, SJSU) | **Team Size:** TBA
Focus Areas: Mechanical Design, Biosensing & Transducing, Control, Biomechanism & Bio-Instrumentation

Students will re-design a neck collar used in the variable-pressure neck chamber technique. The collar applies short (5-second) bursts of pressure and suction, ranging from +40 to –80 Torr, to the neck—simulating carotid hypertension and carotid hypotension, respectively. The application of neck pressure (NP) and neck suction (NS) is performed using a malleable lead neck collar that fits around the anterior two-thirds of the neck. Pressure changes are delivered by a controlled valve, and a pressure transducer connected to the collar accurately measures the applied stimulus. This state-of-the-art technique for human studies investigates neural control mechanisms of the cardiovascular system through carotid baroreceptor stimulation, providing valuable insights into the interactions between the afferent nervous system (via the arterial baroreflex) and the efferent nervous system (via sympathetic nervous system activity), both regulated at the brainstem level.

ME195A SECTION 04 BY PROF. SYED ZAIDI

1. **Three Jabil Company Projects**
   Note: Students will be selected by Jabil via their own application and interview process.
   Here are three projects:
   a. Liquid Cooling: This investigation focuses two parts - development of a system and using it for the thermal characterization of liquid-cooled cold plates used for high-power electronic and optical systems. The study evaluates key performance metrics such as thermal resistance, pressure drop, flow uniformity, and heat removal efficiency across various flow rates and coolant types. Experimental testing and computational modeling are used to analyze the influence of cold plate design features—including channel geometry, material selection, and surface finish—on cooling performance. The goal is to optimize cold plate configurations for efficient, reliable thermal management in applications such as data centers, power electronics, and co-packaged optics.
   b. Advanced Bonding of Plastic to Plastic: This investigation explores different bonding methods for joining plastic-to-plastic interfaces without the use of adhesives, focusing

on direct bonding mechanisms such as UV-induced surface activation, localized polymerization, and thermal fusion. Central to the study is the design and development of a custom bonding system, incorporating controls and precise alignment capabilities. The system is tailored to enable uniform energy delivery and compatibility with various thermoplastics. In addition, the project is to characterize the bond strength, structure and reliability based on the bonding technique. This research aims to achieve clean, strong, and optically clear bonds for high-precision applications in microfluidics, medical devices, and optical packaging, while eliminating the need for chemical adhesives.

c. UC-Activated Adhesives: This investigation focuses on the performance and processing of pre-UV activated adhesives, which are partially cured using ultraviolet light before final bonding. The study includes the design and development of a specialized UV activation system tailored to control key parameters such as wavelength, intensity, exposure time, and uniformity of irradiation. By optimizing the UV system alongside adhesive formulation, the research evaluates how pre-activation influences tack, open time, bond strength, and final cure quality. The goal is to enable precise, consistent adhesive activation for advanced applications in microelectronics, medical devices, and precision optics.

2. SJSU Projects

Project 4: Design a drone with Four off-center rotors and characterizing its performance using an inbuilt Thrust Stand.

Traditional quadcopters utilize four symmetrically placed rotors for stable flight. The rotors work in pairs, with two spinning clockwise and two counter-clockwise, to cancel out torque and maintain stability. In the current project, drone with off center rotors will be designed. Introducing off-center rotors would break the symmetry, making the drone an asymmetrical quadcopter. A thrust stand will be utilized to measure the thrust of the drone at various operating conditions. Various blades will be 3D printed to investigate the impact of blade design on the drone performance.

Project 5: 3D printing of soft material/Soft Robotics
(Co-supervisor Professor Lin Jiang)

The motivation for the project is to develop a 3D printer that can print silicone parts with user-defined features, such as the air channels required for motion powered by pneumatics. The final aim is to make a reliable soft 3D printer easy to use with high accuracy. Soft robotics is emerging as an innovative technology for medical applications.

Note: Prof. Zaidi will be happy to entertain students proposed projects as well – depending on our mutual discussion and agreement.