



Department Project Information

Department Name	MEES	Date Submitted	12/09/2024
Project Title	Design and Manufacture of an Automotive Brake Dynamometer – Phase 2 (UNCC_ME_DYNO2	Planned Starting Semester	Spring 2025

Senior Design Project Description

Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project.

Please provide your estimate of staffing in the below table. The Senior Design Committee will adjust as appropriate based on scope and discipline skills:

Discipline	Number	Discipline	Number
Mechanical	5-6	Electrical	
Computer		Systems	
Other ()			

Project Overview:

The motorsports program at Charlotte supports a number of competition cars as student projects, including two Formula SAE design competition teams. These cars allow students to apply hands on the concepts they learn in the program, and explore the topics more deeply. As the students design and develop these cars, they must make data-driven decisions. A brake dynamometer is a piece of laboratory test equipment that allows the braking system of a car to be operated under controlled but simulated realistic conditions, and data collected from the braking event to help assess brake component selection and design decisions.

A previous Senior Design team designed and constructed such a dynamometer to support operations in the Kulwicki Motorsports Laboratory. To improve the use of this equipment, the program is seeking a redesign and redevelopment of certain aspects of the existing dynamometer. This dynamometer uses an electric motor and chain drive to spin a brake disc and connected mass representing the rotational inertia equivalent of $\frac{1}{4}$ of vehicle weight to desired operating speed. An electronic controller actuates the braking system, and temperature, load, and rotational velocity sensors gather data from the system during this event. This data is then processed and output to the user. Changes to the mechanical design of the system are desired.

Project Requirements:

This project must develop the existing brake dynamometer system in the following areas:

- Convert to belt drive from chain drive, including an appropriately sized electric motor.
- Redesign, fabrication, and assembly of a new safety enclosure. This should contain all parts in the



event of a catastrophic failure during operation, open to allow changing of components and configuration, and maintain a clean and professional look when closed. The enclosure should securely and completely latch.

- Reduce the overall physical dimensions of the assembled dynamometer.
- Redesign inertial load mounting system to increase precision and stiffness and to reduce vibration while running.
- The existing control and sensor system should be left as-is except for modifications as needed to account for above noted changes.

Expected Deliverables/Results:

- Fully fabricated and assembled dynamometer ready for use, modified from existing machine
- All CAD files and renderings
- BOM for all components
- Software for control and results output if modified from original
- Documentation instructing on the safe and correct use of the dynamometer

Disposition of Deliverables at the End of the Project:

Hardware developed is the property of the mentor and department.

List here any specific skills, requirements, specific courses, club affiliation, knowledge needed or suggested (If none please state none):

- Machine Design
- Motorsports Concentration
- Electric motor experience