

TO: The Faculty of the College of Engineering

FROM: The Faculty of the School of Mechanical Engineering

RE: MSPE 33000 Systems Engineering for Motorsports – new course

The Faculty of the School of Mechanical Engineering has approved the following new course. This action is now submitted to the Engineering Faculty with a recommendation for approval.

MSPE 330: Systems Engineering for Motorsports

Credits: 3 credits

Offered: Fall

Prerequisite: MSPE 29800 (Computer Modeling for Motorsports)

Co-requisite: ME 36500 (Measurement and Control Systems I), ECE 20001 (Electrical Engineering Fundamentals I), ECE 20007 (Electrical Engineering Fundamentals Lab I)

Description:

Systems engineering encompasses the engineering knowledge to specify, design, program and analyze the electrical systems of a motorsports vehicle. The course will explore those systems to provide the engineering foundation in instrumentation, data analysis, data reduction, and system programming. Project work will supplement the learning outcomes through direct engagement of designing and specifying a data system for a motorsports vehicle, manufacturing a motorsports vehicle sensor loom, and programming the communication pathways between different vehicle electrical systems.

ABET General Criteria Outcomes:

- 2 – An ability to communicate effectively with a range of audiences
- 3 – An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
- 4 – An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions

Learning Outcomes:

- Understand the fundamentals of the data acquisition systems installation, operation, software, and maintenance, while appreciating the importance of data integrity
- Understand the implications of design decisions when designing the data acquisition system or designing around the data acquisition system.
- Understand the limitations and possibilities of the data acquisition system.
- Utilize data acquisition analysis tools to properly import and display data signals.
- Understanding on how to write math channels to interpret and analyze data.
- Initial understanding of how recorded data represents vehicle and driver performance.
- Utilize motorsports wiring tools to manufacture a motorsports sensor harness.
- Understand the basics of digital car communication including the math associated with communicating digital signals throughout the vehicle.

Background:

MSPE 33000 Data Acquisition for Motorsports I was the original course offered in the Motorsports Engineering Program. After the 2016 ABET audit of the program the plan of study was revised to align with comments provided by the ABET evaluator and the program directors personal audit of the program. The credit hour requirement for MSPE 33000 was reduced from three to two and the class was indexed to 33001 to denote the adjustment. Transitioning the Motorsports Program from IUPUI to the School of Mechanical Engineering, Purdue University allowed for a complete review and optimization of the programs plan of study. One result of the review was to align MSPE 33000 with feedback provided by the members of the motorsports industry advisory board. The name of the class is changing from Data Acquisition for Motorsports I to Systems Engineering for Motorsports to be consistent with the Systems Engineering title/position most of the motorsports students hire into upon graduation. The credit hour requirement for the class will be 3-credit hours an increase of 1-credit hour from the original 2-credit hour. This decision is based on course feedback from alumni, motorsports industry engineers and members of the Industry Advisory Board. The increase in the credit hour requirement of the course will allow the addition of topical information that will ensure a broader depth of system engineering knowledge being taught to the students in the program.



1/15/2025

Christopher E Finch, Professor of Practice and Site Director Motorsports Engineering
School of Mechanical Engineering

MSPE 33000 – Systems Engineering for Motorsports

- Description:** Systems engineering encompasses the engineering knowledge to specify, design, program and analyze the electrical systems of a motorsports vehicle. The course will explore those systems to provide the engineering foundation in instrumentation, data analysis, data reduction, and system programming. Project work will supplement the learning outcomes through direct engagement of designing and specifying a data system for a motorsports vehicle, manufacturing a motorsports vehicle sensor loom, and programming the communication pathways between different vehicle electrical systems.
- Prerequisites:** MSPE 29800 Computer Modeling for Motorsports
- Co-requisites:** ME 36500 Measurement and Control Systems I
ECE 20001 Electrical Engineering Fundamentals I
ECE 20007 Electrical Engineering Fundamentals Lab I
- Instructor:** Chris Finch
Office: SL 160K
Email: finch21@purdue.edu
- Text:** None Required
- Goals:** This course will provide an overview of track side data acquisition, including engine data, chassis data, and driver inputs. Students will learn the basics of data acquisition system design and explore applications in hardware and software for acquiring pertinent data and analyzing it for improvement of vehicle performance.

ABET General Criteria Outcomes:

After completion of this course, the students should exhibit ability to:

- 2 – An ability to communicate effectively with a range of audiences
- 3 – An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
- 6 – An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

Course Level Outcomes:

After completion of this course, the students should exhibit ability to:

- Understand the fundamentals of the data acquisition systems installation, operation, software, and maintenance, while appreciating the importance of data integrity
- Understand the implications of design decisions when designing the data acquisition system or designing around the data acquisition system.
- Understand the limitations and possibilities of the data acquisition system.
- Utilize data acquisition analysis tools to properly import and display data signals.
- Understanding on how to write math channels to interpret and analyze data.
- Initial understanding of how recorded data represents vehicle and driver performance.
- Utilize motorsports wiring tools to manufacture a motorsports sensor harness.
- Understand the basics of digital car communication including the math associated with communicating digital signals throughout the vehicle.

Course Topics:

- Data Acquisition System Overview
- Data Engineer Responsibilities
- Data Acquisition Hardware and Hardware Installation
- Sensor Types and Functions
- Wiring Basics, to include
 - Connectors
 - Wire Type
 - Installation
 - Installation Drawings
- Data Integrity
- Performance Analysis

- Engine Systems
- Driver/Car

Assignment Submission: All assignments will be submitted per the instructions listed at the time the assignment is given. Failure to submit the assignment in the manner that is requested may result in a 0 for that assignment. Therefore, please read and understand what is being asked of you when you are working on and submitting your assignments. All assignments will be submitted via the Assignment Tab in Brightspace unless otherwise noted.

Exams/Quizzes: Unless otherwise noted, all exams and quizzes will be taken during class time. The time allotted for the exam will be delineated at the beginning of the exam. Extra time allotted for the exam is at the instructors' discretion. The official submission time, as delineated by the instructor during the time allotted for the exam, supersedes the submission time noted in Brightspace. The Final Exam will be taken during final exam week at the time as specified by the University Registrar with no exceptions.

Late Work: Assignments, Projects and Exams are due on the specified date at the specified time.

- Late work will not be accepted.
- Valid late work or make-up exams require written instructor permission
- At the instructor's discretion, a 10% per day late penalty may be applied to valid late work.
- The submission date and time on Brightspace or contained within the Assignment will be used as the official submission time.

Bonus: Bonus problems or assignments may be assigned to help the student better understand difficult material or "make-up" points for poor performance on Exams or Homework. Assigning bonuses are at the discretion of the instructor. The instructor, at his discretion, may elect to not provide bonus points on bonus problems in which the assignment is submitted late.

Grading Policy: The grading structure for the class is delineated in the table below. The points as allocated may be adjusted during the semester to properly reflect the semester course load. The instructors' expectation is for all students to meet or exceed an average working knowledge of all concepts presented in class. Therefore, the course is graded on a straight scale as shown with the anticipation of the average class performance to be 80% or C+/B-. "Curving" or adjusting grades to reflect class performance should not be inferred or assumed by the students. Completing homework assignments should be considered the minimum requirement to meet basic expectations. Obtaining an above average working knowledge and an above average grade requires significantly more effort, which is at the discretion of the student.

The instructor will adhere to the following guidelines when determining whether a student receives an Incomplete (I) grade for the class. The awarding of an incomplete grade implies the student, working with the instructor, will complete the required course work within an acceptable time frame. Upon successful completion of the course work the instructor will request a grade change from the Universities Registrar.

- Unusual circumstances such as an illness that prevent the student from completing the work
- The student has successfully completed 75% of the required course work
- The student, at the time the incomplete is requested, is successfully passing the course. Successful completion of the required course work ensures the student will pass the course.

Item	Points	Weighting	Scale	
Lab Projects	350	30%	91-100	= A
Lab Quizzes	150	15%	90-90.9	= A-
Lecture HW	400	10%	88-89.9	= B+
Lecture Exams	400	45%	81-87.9	= B
			80-80.9	= B-
Exams	Points	Target Dates	78-79.9	= C+
EX001	125	TBD	70-77.9	= C
EX002	125	TBD	60-60.9	= D
EX003	150	TBD	<=59.9	=F