TO: The Faculty of the College of Engineering

FROM: The Faculty of the School of Mechanical Engineering

RE: MSPE 43100 Race Engineering

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 431: Race Engineering
Credits: 3 credits
Offered: Spring
Prerequisite: MSPE 33000 (Systems Engineering in Motorsports), MSPE 47200 (Vehicle Dynamics)
Co-requisite: MSPE 48200 (Motorsports Aerodynamics)

Description:
Motorsports engineering knowledge obtained throughout the curriculum are brought together to create foundational knowledge in the discipline. Analytical tools in Excel or Matlab along with data analysis tools from Cosworth or Motec are utilized to guide the application of motorsports engineering principles to vehicle performance optimization. Race strategy topics are investigated to provide foundational knowledge beyond vehicle system.

ABET General Criteria Outcomes:
   1 - An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
   6 – An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
   7 - An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Learning Outcomes:
   • Utilize Excel or Matlab to analyze vehicle systems and performance.
   • Utilize Cosworth Toolbox or Motec i2 software to analyze vehicle systems and performance.
   • Calculate fuel error and its impact on race strategy.
   • Understand tire degradation principles and its impact on race strategy.
   • Write technical reports to disseminate the technical information in a clear and concise manner.

Background:
MSPE 43100 Race Engineering was a course offered in the Motorsports Engineering program as MSPE 33100 Data Acquisition for Motorsports II. 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 this review was to align MSPE 43100 with the feedback provided by members of the motorsports industry advisory board. The change in the course name aligns with the material being taught in the course and provides a unique course identification within the program. The course was originally taught during the sixth semester. The course will now be taught in the eighth semester as part of the culmination of knowledge students gain throughout the program. The material in the course will develop and expand as the course matures in its new offering sequence. The addition of MSPE 48200 Motorsports Aerodynamics as a co-requisite allows for expanding motorsport aerodynamic material already included in the course.

1/15/2025

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

MSPE 431 – RACE ENGINEERING

Syllabus

Description: Motorsports engineering knowledge obtained throughout the curriculum are brought together to create foundational knowledge in the discipline. Analytical tools in Excel or Matlab along with data analysis tools from Cosworth or Motec are utilized to guide the application of motorsports engineering principles to vehicle performance optimization. Race strategy topics are investigated to provide foundational knowledge beyond vehicle system.

Prerequisites: MSPE 33000 Systems Engineering for Motorsports
MSPE 47200 Vehicle Dynamics
Co-requisites: MSPE 48200 Motorsports Aerodynamics

Instructor: Chris Finch
Office: SL 160K

Email: finch21@purdue.edu

Text: Analysis Techniques for Racecar Data Acquisition by Jorge Segers ISBN: 978-0768016550

ABET General Criteria Outcomes:
After completion of this course, the students should exhibit the ability to:
1 - An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
6 – An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7 - An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Course Level Outcomes:
After completion of this course, the students should exhibit the ability to:
- Utilize Excel or Matlab to analyze vehicle systems and performance
- Utilize Cosworth Toolbox or Motec i2 software to analyze vehicle systems and performance
- Calculate fuel error and its impact on race strategy
- Understand tire degradation principles and its impact on race strategy
- Write technical reports to disseminate the technical information in a clear and concise manner

Course Topics:
- Analysis of Vehicle Dynamics Fundamentals
  - Straight-line Performance
  - Cornering Performance
  - Mechanical Balance
  - Aerodynamics
  - Differentials
  - Ride
  - Driver Performance
- Race Strategy
  - Fuel Error and Fuel Mileage
  - Tire Degradation

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 Canvas and/or at the Start of Class 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 official exam time supersedes the submission time as noted in Canvas. 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 Canvas or on the Assignment will be used as the official submission time.

Bonus: Bonus problems or assignments may be assigned to help students 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 their 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 or not 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.

PURDUE MOTORSPORTS

Grading Policy Table:

Item	Points	Weighting	Scale	
Assignments	500	20%	91-100	= A
Exams	500	80%	90-90.9	= A-
Total	1000	100%	88-89.9	= B+
			81-87.9	= B
			80-80.9	= B-
Exams	**Points**	**Target Dates**	78-79.9	= C+
EX001	150	TBD	70-77.9	= C
EX002	150	TBD	60-60.9	= D
EX003	200	TBD	<=59.9	=F