Prifysgol Wrecsam
Wrexham University

Module specification

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Module Code	ENG5C4
Module Title	Chassis and Suspension Design
Level	5
Credit value	20
Faculty	FACE
HECoS Code	100206
Cost Code	GAME
Pre-requisite module	N/A

Programmes in which module to be offered

Programme title	Core/Optional/Standalone
BEng (Hons) Motorsport Engineering BEng (Hons) Motorsport Engineering with Foundation Year	Core

Breakdown of module hours

Learning and teaching hours	24 hrs
Placement tutor support hours	0 hrs
Supervised learning hours e.g. practical classes, workshops	24 hrs
Project supervision hours	0 hrs
Active learning and teaching hours total	**48 hrs**
Placement hours	0 hrs
Guided independent study hours	152 hrs
Module duration (Total hours)	**200 hrs**

Module aims

This module develops applied understanding through a balance of theory and practice. Learners undertake both classroom study and supervised practical activity to explore design, implementation, and evaluation processes. Collaborative work and enquiry-based learning foster communication, teamwork, and the confidence to apply problem-solving techniques in varied contexts.

This module aims to develop students' ability to analyse, measure, and design chassis and suspension systems for motorsport applications, combining analytical methods with practical investigation to support progression to advanced Level 6 vehicle dynamics modules.

Module Learning Outcomes

At the end of this module, students will be able to:

1	Analyse chassis and suspension systems using principles of kinematics and dynamics to explain their influence on vehicle handling performance.
2	Design and justify suspension geometry modifications to meet defined performance targets, applying appropriate analytical and computational techniques while recognising their limitations.
3	Select, evaluate, and apply technical literature, standards, and measured data to assess chassis and suspension characteristics and present justified engineering conclusions in a structured technical report.

Assessment

Indicative Assessment Tasks:

This section outlines the type of assessment task the student will be expected to complete as part of the module. More details will be made available in the relevant academic year module handbook.

Assessment 1: Portfolio

Assessment is by a portfolio covering practical measurement and individual investigation work. Students will measure chassis and suspension parameters such as toe, camber, caster, roll centre position, and bump-steer using appropriate workshop equipment, and combine these measurements with analytical evaluation, geometry justification, diagrams, and calculations.

Assessment number	Learning Outcomes to be met	Type of assessment	Duration/Word Count	Weighting (%)	Alternative assessment, if applicable
1	1-3	Portfolio	3000	100	N/A

Derogations

Credits shall be awarded by an Assessment Board for those modules in which a pass mark 40% has been achieved, with a minimum mark of 30% in each assessment element.

Learning and Teaching Strategies

Learning integrates conceptual study with practical investigation to deepen understanding and enhance problem-solving ability. Students participate in lectures, laboratory work, and team-based projects that encourage collaboration and communication. Online materials, recordings, and discussion forums support blended engagement. Tutorials promote reflective learning and increasing autonomy in preparation for advanced study.

Welsh Elements

This module will be delivered through the medium of English; however, students have the option to submit their assessments in the medium of Welsh. While this module is not currently offered fully through Welsh, Welsh language support and guidance are available, and some learning materials or tutorial discussions may incorporate Welsh elements where appropriate.

Indicative Syllabus Outline

- Chassis role and performance metrics

  Function of chassis and suspension in motorsport performance, handling, and tyre utilisation. Key definitions and targets: toe, camber, caster, KPI, roll centre, motion ratio, bump steer, scrub radius, track, wheelbase.

- Suspension architectures and kinematics (Level 5 analytical focus)

  Double wishbone layout and common variants, front and rear packaging constraints. Coordinate systems and hard point definition principles (concept-level). Plan-view and side-view geometry, instant centres, camber gain, caster effects. Small-angle assumptions where appropriate and limits of simplified geometry models.

- Steering geometry and compliance behaviour

  Ackermann principles and steering arm geometry intent. Bump steer generation mechanisms and target setting logic. Compliance sources (bushes, joints, steering system), qualitative impact on toe and camber under load.

- Springs, dampers, anti-roll devices

  Wheel rate vs spring rate, motion ratio effects, practical feasibility checks. Damping concepts: compression and rebound, qualitative effect on transient response. Simple modelling of vertical stiffness distribution and implications for balance.

- Tyre and chassis interaction (simplified handling links)

  Tyre stiffness concepts, sensitivity to load, basic interpretation of tyre data. Qualitative link between kinematics (camber/toe control) and contact patch utilisation. Limits of linear assumptions and why real behaviour deviates.

- Measurement and workshop-based investigation

  Practical methods: ride height, corner weights, camber, toe, caster, steering angle, bump steer measurement. Data quality: repeatability, uncertainty, sources of error and how to reduce them. Converting measurements into engineering conclusions and recommendations.

- Applied analysis and reporting

  Using measured data and technical literature to justify conclusions. Producing clear diagrams, calculation steps, and evidence-based recommendations. Traceability: assumptions stated, units consistent, conclusions linked to evidence.

Indicative Bibliography

Please note the essential reads and other indicative reading are subject to annual review and update.

Essential Reads:

Adams, Herb. *Chassis Engineering (HP1055): Chassis Design, Building & Tuning for High Performance Handling*. HPBooks, 1992

Other indicative reading:

W. F. Milliken, Chassis Design: Principles and Analysis, SAE Technical Paper Series, SAE International, Warrendale, PA, USA.

M. Blundell and D. Harty, The Multibody Systems Approach to Vehicle Dynamics, 2nd ed., Oxford, UK: Butterworth-Heinemann, 2015.

S. Milliken and D. Milliken, Race Car Vehicle Dynamics, Warrendale, PA, USA: SAE International, 1995.

Administrative Information

For office use only	
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