

Module Title:	Motorsport Vehicle Dynamics
Date Of Validation:	2011
Module Number	M5X9485
Module Value:	15 credits
Level:	5
Faculty Responsible for Delivery:	Faculty of Applied Design and Engineering
Prerequisites:	None

AIM:

The aim of this module is to develop an understanding of the factors affecting the dynamic performance of a competition car suspension system and so to enable the modification of its handling characteristics to be undertaken.

OUTCOME STATEMENTS:

Upon the successful completion of this module the student will be able to:

1. Use a data acquisition system to measure and analyse a competition car's dynamic performance.
2. Quantify and predict the result of suspension changes on a competition car's handling and balance.

INDICATIVE CONTENT:

Roll stiffness distribution changes using springs and anti-roll bars
 Weight transfer due to unsprung mass, Sprung mass at roll centre height and Sprung mass acting about roll centre axis,
 Determination of body roll angle,
 Force producing lateral acceleration.
 Total lateral forces (self aligning torque, drag distribution, camber thrust).
 Tyre performance characteristics.
 Influence of load distribution on handling balance
 Data acquisition use and operation
 Data analysis software for vehicle perform analysis

TEACHING AND LEARNING IMPLEMENTATION:

	Hours
Lectures	45
Laboratory (supervised)	45
Tutorials/Seminars	0
Student private study	60

TOTAL

150

The module will be delivered by lectures and practical coursework. Students will apply the theoretical concepts to practical situations including workshop based testing and track testing

ASSESSMENT:

Outcomes	Assessment Criteria To achieve each outcome a student must:
1 Use a data acquisition system to measure and analyse a car's dynamic performance.	Organise a track test. Set up and use a data acquisition system to enable relevant data to be collected and stored accurately and vehicle performance to be quantified.
2 Quantify and predict the result of suspension changes on a competition car's handling and balance.	Calculate wheel load distribution for a competition car undertaking a given manoeuvre, to specify changes to its suspension setup to achieve a desired handling characteristic and to verify the effect of these changes by practical track testing

ASSESSMENT STRATEGY:

There are two 40% assignments / coursework consisting of assignment 1 covering outcome 2 and assignment 2 covering outcome 1. The 20% Phase test covers all 3 outcomes.

Assignment 1	40%
Assignment 2	40%
End Test	20%

RESOURCES:

MTG01 Martyn Jenkins Laboratory Chassis Laboratory
Pembrey Test centre
Instrumented competition car with adjustable suspension and data acquisition systems

READING LIST:

Essential:

Dixon, JC (1996) *Tyres, Suspension and Handling* 2nd ed. SAE, Warrendale

Gillespie,TD (1992) *Fundamentals of Vehicle Dynamics* 2nd ed. SAE, Warrendale

ISO 4138 (1982) *Road Vehicle Steady State Test Procedure*

Bastow, D, Howard, G and Whitehead, J (2004) *Car Suspension and Handling*, 4th ed. SAE, Warrendale

Background:

Bolles, B (2006) Asphalt Handling Fixes, *Circle Track Magazine*, September

Haney, P (2003) *The Racing & High Performance Tyre*,TV Motorsports, Redwood City

Heisler Heinz (2007) *Advanced Vehicle Technology* (Edward Arnold)

Milliken, WF and Milliken, DL (1995) *Race Car Vehicle Dynamics*, SAE, Warrendale

Rowley, W (2005) *An Introduction to Race Car Engineering* 3rd ed. Rowley Race Dynamics, Calgary

Smith, C (1978) *Tune to Win* Aero Publishers, Fallbrook

Smith, C (1985) *Engineer to Win* Publishers, Fallbrook

Smith, S (2000) *Trackside Chassis Tuning Guide*, Steve Smith Autosports, Santa Ana

Staniforth, A (1999) *Competition Car Suspension* 3rd ed. Haynes, Sparkville

Weighell, P (2006) *Shortcut to Success Racecar Engineering*, V16 No10 p56-p64

STAFF RESOURCES:

Module Leader: R A Dowden

Staff delivering this module: R A Dowden