

# ES3A9-15 Design for Vehicle Safety

23/24

**Department**

School of Engineering

**Level**

Undergraduate Level 3

**Module leader**

Matthew Pitts

**Credit value**

15

**Module duration**

10 weeks

**Assessment**

50% coursework, 50% exam

**Study location**

University of Warwick main campus, Coventry

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## Description

### Introductory description

ES3A9-15 Design for Vehicle Safety

[Module web page](#)

### Module aims

This key automotive-specific module will introduce the concept of design for vehicle safety. The module aims to promote an understanding and an interest in the issues of design for safety for the vehicle structure as well as considering some of the automotive systems which contribute to safety aspects. This module will draw upon the close links that WMG has with the automotive industry to deliver industry-relevant theory and applied engineering.

### Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

What is automotive safety; history, why and how  
The role of material science in design for vehicle safety  
Material selection for design for safety

Automotive structure and safety  
Safety aspects of design for BIW  
Crashworthiness legislation  
Crash analysis; front/rear impact and side crash  
The role of Human-Machine Interface in vehicle safety  
CAE/FEA in analysis of vehicle structures  
Fatigue failure analysis for vehicle structures  
The role of different vehicle sub-systems in safety aspects  
Passive and Active safety systems

## **Learning outcomes**

By the end of the module, students should be able to:

- Communicate core scientific and engineering principles that underpin design for vehicle safety
- Explain developing trends in vehicle safety
- Model key physical principles relating to vehicle safety including kinetics and fatigue
- Create an analytical model of a simple structure and understand how these principles apply to mathematical modelling and CAE for vehicle safety structures

## **Indicative reading list**

Radhakanta Rana, Shiv Brat Singh, Automotive steels : design, processing and applications, 2017  
Mehrdad Ehsani, Fei-Yue Wang and Gary L. Brosch, Transportation technologies for sustainability, 2013  
Bhise, Vivek D., Ergonomics in the automotive design process, 2012  
Davies, G, Materials for Automobile Bodies. Butterworth Heinemann. 2003  
Dearborn, M. H. Vehicle Crash Dynamics. CRC Press 2002  
Dixon, J.C. Tyres, Suspension and Handling, Cambridge University Press, 1991  
Bastow, D; Howard, G; Whitehead, J. P; Car Suspension & Handling 4th Edition. Wiley 2004  
Matthew Huang "vehicle crash mechanics", 2002  
Jason C. Brown, "Motor vehicle structure", 2002  
M.J. Fagan, "Finite element analysis : theory and practice", 1992  
Close, C, M; Frederick, D. K; Newell, J. C. Modelling and Analysis of Dynamic Systems 3rd Edition, Wiley 2002

[View reading list on Talis Aspire](#)

## **Subject specific skills**

Ability to conceive, make and realise a component, product, system or process  
Ability to be pragmatic, taking a systematic approach and the logical and practical steps necessary for, often complex, concepts to become reality  
Ability to be risk, cost and value-conscious, and aware of their ethical, social, cultural, environmental, health and safety, and wider professional engineering responsibilities

## **Transferable skills**

Numeracy: apply mathematical and computational methods to communicate parameters, model and optimize solutions

Apply problem solving skills, information retrieval, and the effective use of general IT facilities

Communicate (written and oral; to technical and non-technical audiences) and work with others

Plan self-learning and improve performance, as the foundation for lifelong learning/CPD

Exercise initiative and personal responsibility, including time management, which may be as a team member or leader

Awareness of the nature of business and enterprise in the creation of economic and social value

Overcome difficulties by employing skills, knowledge and understanding in a flexible manner

Appreciation of the global dimensions of engineering, commerce and communication

Be professional in their outlook, be capable of team working, be effective communicators, and be able to exercise responsibility and sound management approaches.

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## Study

### Study time

Type	Required
Lectures	24 sessions of 1 hour (16%)
Practical classes	1 session of 3 hours (2%)
Other activity	2 hours (1%)
Private study	121 hours (81%)
Total	150 hours

### Private study description

Guided independent learning including interactive online activities

### Other activity description

2 x 1 hour revision classes, term 3

### Costs

No further costs have been identified for this module.

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## Assessment

You must pass all assessment components to pass the module.

Students can register for this module without taking any assessment.

## Assessment group C4

	Weighting	Study time
Written Assignment 2000 words	50%	
Online Examination QMP ~Platforms - QMP	50%	

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- Online examination: No Answerbook required
- Students may use a calculator
- Engineering Data Book 8th Edition
- Graph paper

## Feedback on assessment

Written comments and electronically marked-up assignment  
Cohort level feedback on examination

[Past exam papers for ES3A9](#)

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## Availability

### Courses

This module is Core for:

- Year 3 of UESA-H335 BEng Automotive Engineering
- Year 4 of UESA-H334 BEng Automotive Engineering with Intercalated Year
- Year 3 of UESA-H336 MEng Automotive Engineering

This module is Core optional for:

- Year 4 of UESA-H334 BEng Automotive Engineering with Intercalated Year
- Year 4 of UESA-H337 MEng Automotive Engineering with Intercalated Year
- Year 3 of UESA-H115 MEng Engineering with Intercalated Year
- Year 3 of UESA-H11L Undergraduate Engineering (with Intercalated Year)

This module is Optional for:

- Year 3 of UESA-H113 BEng Engineering

- Year 3 of UESA-H114 MEng Engineering
- Year 4 of UESA-H115 MEng Engineering with Intercalated Year
- UESA-H11L Undergraduate Engineering (with Intercalated Year)
  - Year 3 of H11L Engineering (with Intercalated Year)
  - Year 4 of H11L Engineering (with Intercalated Year)

This module is Option list A for:

- Year 4 of UESA-H111 BEng Engineering with Intercalated Year
- UESA-H112 BSc Engineering
  - Year 3 of H112 Engineering
  - Year 3 of H112 Engineering

This module is Option list B for:

- Year 3 of UESA-HN12 BEng Engineering Business Management
- Year 3 of UESA-HN15 BEng Engineering Business Management
- Year 4 of UESA-HN13 BEng Engineering Business Management with Intercalated Year