WM9D3-15 Circular (eco)design and Life Cycle Engineering

24/25

Department
WMG
Level
Taught Postgraduate Level
Module leader
Neill Raath
Credit value
15
Module duration
5 days
Assessment
100% coursework
Study location
University of Warwick main campus, Coventry

Description

Introductory description

The module will give a broad overview of the challenges arising from pursuing sustainable production in the automotive industry. Students will gain insight into topics such decarbonisation pathways, material circularity, environmental impact of materials processing and reuse/remanufacturing. Students will also be introduced to a range of tools to interpret these environmental challenges, such as Life Cycle Engineering tools (material selection, manufacturing selection, end-of-life) and Life Cycle Analysis.

Module aims

To provide comprehensive knowledge, and practical application, of life cycle oriented engineering tools for materials selection, manufacturing and end-of-life.
To provide an advanced understanding of the environmental effects of material substitution/reduction, associated manufacturing changes and end-of-life.
To provide knowledge of the state-of-the-art in recycling, reuse and remanufacturing in industry, including Industrial Symbiosis (utilising waste from manufacturing).
To provide insights into the opportunities for bio-based materials in high volume manufacturing.

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.

- Decarbonisation pathways for key automotive materials
- The implication of transport as a service on reuse & recycling
- Barriers and solutions to increased material circularity
- Supply chain risks associated with key electrification materials
- Risk and benefits associated with the use of renewable material
- Recycling technologies of different material families
- Environmental impact and embedded energy of materials processing
- Environmental effects of material substitution and associated process changes
- Reuse and remanufacturing in industry
- Bio-based materials
- Life Cycle Engineering tools (material selection, manufacturing, end-of-life)
- Life Cycle Analysis
- Practical application of life cycle tools

Learning outcomes

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

- Interpret the key sustainability factors affecting the automotive industry and the associated environmental, social and economic drivers within the following three key areas: (1) Global warming and climate change (2) Resource use and circularity (3) Material provenance and ethics
- Evaluate the potential conflicts between different sustainability factors, where attempts at improving circularity could lead to increases in global warming.
- Evaluate the environmental effects of engineering and/or material changes, with regards to embodied energy, changes in manufacturing methods and maturity/efficiency of end-of-life processes.
- Practical application of state-of-the-art life cycle engineering tools, such as Life Cycle Assessment, Circular Economy methods and Lightweighting techniques.
- Appraise and critique various lightweighting solutions regarding environmental impact.
- Evaluate the economics of pursuing environmentally sustainable manufacturing policies.

Indicative reading list

Sustainable manufacturing: Challenges, solutions and implementation perspectives, R. Stark, G. Seliger, and J. Bonvoisin. Springer Nature, 2017. ISBN: 9783319485140

The Circular Economy Handbook: Realizing the Circular Advantage, P. Lacy, J. Long and W. Sprindler. Macmillan, 2020. ISBN: 9781349959686

Automotive recycling, plastics, and sustainability : the recycling renaissance, D. Schönmayr. Springer, 2017. ISBN: 9783319574004

View reading list on Talis Aspire

Subject specific skills

The module will develop the following subject specific skills: Life Cycle Engineering practice, Appraisal and critique of sustainable manufacturing policies, Knowledge of key sustainability factors.

Transferable skills

Collaborative working, Critical thinking and analysis, Academic writing skills

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Study

Study time

Type	Required
Lectures	25 sessions of 1 hour (17%)
Seminars	6 sessions of 1 hour (4%)
Tutorials	3 sessions of 1 hour (2%)
Practical classes	3 sessions of (0%)
Supervised practical classes	5 sessions of 1 hour (3%)
Online learning (independent)	51 sessions of 1 hour (34%)
Assessment	60 hours (40%)
Total	150 hours

Private study description

No private study requirements defined for this module.

Costs

No further costs have been identified for this module.

Assessment

You do not need to pass all assessment components to pass the module.

Assessment group A1

	Weighting	Study time
Post Module Assessment	80%	48 hours

A written report investigating the environmental and manufacturing effects of implementing the optimal material for a selected automotive component/system. This report will consider areas such as decarbonisation pathways, material circularity, material embedded energy, recycling technologies, reuse & remanufacturing and finally practical application of Life Cycle Engineering tools.

In-module assessment	20%	12 hours

Critical evaluation of environmental effects of material usage in automotive applications..

Feedback on assessment

In-class debrief of performance on in-module activity. Written feedback, of approximately 300 - 400 words, will be provided 4 weeks after the date of submission of the PMA. The feedback will be focussed on the strengths and weaknesses of the work with regards to the module learning objectives and the post module assessment marking guidelines. Suggestions for improvement will also be provided.
A formative peer review will be included, with results to be shared with student.

Availability

There is currently no information about the courses for which this module is core or optional.