

ES2D7-15 Systems and Software Engineering Principles

25/26

Department

School of Engineering

Level

Undergraduate Level 2

Module leader

Thomas Popham

Credit value

15

Module duration

15 weeks

Assessment

100% coursework

Study location

University of Warwick main campus, Coventry

Description

Introductory description

ES2D7-15 Systems and Software Engineering Principles

[Module web page](#)

Module aims

Introduce students to the concept of systems engineering and systems thinking. Guide students to expand their thinking about design to incorporate structured methods from Systems and Software Engineering including model based approaches. Ensure that students are able to consider functional and non-functional behaviour when creating requirements as well as predicting failure modes. Impress upon students the importance of correct and traceable requirements on product success as well as on safety and the environment. Exploit the synergies between Systems and Software Engineering processes to introduce formal software engineering to students.

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.

Introduction to systems concepts & systems thinking

Systems Lifecycle model (i.e. ISO 15288)

Systems and software development approaches: System Vee, Agile, Waterfall, MBSE

Verification and Validation

Eliciting and analysing user needs (inc. Kano analysis)

Eliciting and writing requirements

P diagrams, FMEA analysis

SysML: use-case, block, activity, state, sequence diagrams

Stateflow as a tool

Object orientated approach: Classes, methods and inheritance.

Software testing techniques

Introduction to system and computer security

Learning outcomes

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

- Select, apply and evaluate approaches to system and software development, including V-model, Waterfall, Agile and MBSE [C6, M6, C13, M13]
- Use a system modelling language (e.g. UML or SysML) to communicate a system design from key perspectives (behavioural, structural) [C6, M6]
- Use appropriate tools to elicit stakeholder needs and write functional and non-functional requirements [C5, M5].
- Apply object-orientated techniques for solving complex problems [C3, M3].
- Work in a team to design and develop a product from initial user/stakeholder needs through to final testing, applying relevant quality techniques [C5, M5, C14, M14, C16, M16].
- Apply an established process to evaluate and address the risks (including technical, safety, commercial and security) that may exist throughout the lifecycle of a complex system [C9, M9, C10, M10]

Indicative reading list

Blanchard, Benjamin S., and W. J. Fabrycky. *Systems Engineering and Analysis*. Harlow: Pearson Education Limited, 2014.. ISBN-13 978-1292025971

A. P. Sage, J. E. Armstrong. *Introduction to Systems Engineering*. Wiley Series in Systems Engineering. Wiley 2000 ISBN-13: 978-0471027669

A. Kossiakoff. "Systems Engineering Principles and Practice" Wiley Series in Systems Engineering. Wiley 2002 ISBN-13: 978-0470405482

Wasson, C., "System Analysis, Design, and Development: Concepts, Principles, and Practices." Wiley Series in Systems Engineering and Management. Wiley 2005. ISBN-13: 978-0471393337

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 seek to achieve sustainable solutions to problems and have strategies for being creative and innovative.

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.

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

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

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

Ability to formulate and operate within appropriate codes of conduct, when faced with an ethical issue

Appreciation of the global dimensions of engineering, customers, 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.

Study

Study time

Type	Required
Lectures	13 sessions of 1 hour (9%)
Seminars	3 sessions of 2 hours (4%)
Practical classes	4 sessions of 2 hours (5%)
Private study	123 hours (82%)
Total	150 hours

Private study description

Private study - Programming Exercises (preparation for in-class test): 61

Private study - systems exam: 62

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group A1

	Weighting	Study time	Eligible for self-certification
Individual Assignment	50%		Yes (extension)
Group Project	50%		No

Assessed by Group presentation (approx 15mins) & peer assessment

Feedback on assessment

Individual assignment: formative feedback during labs, feedback during presentation, written feedback, cohort feedback

Group project: formative feedback during workshop session, written feedback

Availability

Courses

This module is Core for:

- Year 2 of UESA-H335 BEng Automotive Engineering
- Year 2 of UESA-H161 BEng Biomedical Systems Engineering
- Year 2 of UESA-H113 BEng Engineering
- Year 2 of UESA-HH35 BEng Systems Engineering
- Year 2 of UESA-H336 MEng Automotive Engineering
- Year 2 of UESA-H163 MEng Biomedical Systems Engineering
- Year 2 of UESA-H114 MEng Engineering
- UESA-HH31 MEng Systems Engineering
 - Year 2 of HH31 Systems Engineering

- Year 2 of HH35 Systems Engineering

This module is Optional for:

- Year 2 of UESA-H63W BEng Electronic Engineering
- Year 2 of UESA-H315 BEng Mechanical Engineering
- UESA-H112 BSc Engineering
 - Year 2 of H112 Engineering
 - Year 2 of H112 Engineering
- Year 2 of UESA-H63X MEng Electronic Engineering
- UESA-H316 MEng Mechanical Engineering
 - Year 2 of H315 Mechanical Engineering BEng
 - Year 2 of H316 Mechanical Engineering MEng
- Year 2 of UESA-H605 Undergraduate Electrical and Electronic Engineering
- Year 2 of UESA-H606 Undergraduate Electrical and Electronic Engineering MEng