

# ES4E3-15 Structural Dynamics and Health Monitoring.

**22/23**

**Department**

School of Engineering

**Level**

Undergraduate Level 4

**Module leader**

Irwanda Laory

**Credit value**

15

**Module duration**

10 weeks

**Assessment**

40% coursework, 60% exam

**Study location**

University of Warwick main campus, Coventry

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## Description

### Introductory description

ES4E3-15 Structural Dynamics and Health Monitoring

[Module web page](#)

### Module aims

To explore the principles of structural dynamics and health monitoring of civil infrastructure

### 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 structural dynamics in civil engineering
- Single-degree-of-freedom systems
- Multiple-degree-of-freedom systems
- Signal representation in time- and frequency-domain; basics of signal processing

- Components of a vibration measurement system
- Introduction to structural health monitoring of civil infrastructures
- Static and dynamic monitoring
- Model-based and model-free data interpretation methods
- Structural Identification
- Damage detection
- Measurement system design

## Learning outcomes

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

- Demonstrate an advanced understanding of the principles of dynamic behaviour of structures.
- Demonstrate comprehensive understanding of complexities involved in the health monitoring (condition assessment) of modern civil engineering structures.
- Critically assess uncertainties associated with structural identification and damage detection by analysing an experimental setup in laboratory as well as existing bridge in service.
- Demonstrate a systematic knowledge of the design and signal processing principles that underpin the development of vibration data acquisition systems.
- Constructively evaluate and criticise designs of civil engineering structures, in service behaviour and structural condition using measurements.

## Indicative reading list

Williams, M., 2016. Structural Dynamics, CRC Press, Taylor and Francis.

Inman, D. J., 2013. Engineering Vibration, Pearson, 4th ed.

Thorby, D., 2008. Structural Dynamics and Vibration in Practice: An Engineering Handbook, Butterworth-Heinemann.

## Subject specific skills

1. Ability to conceive, make and realise a component, product, system or process
2. Ability to develop economically viable and ethically sound sustainable solutions
3. Ability to be pragmatic, taking a systematic approach and the logical and practical steps necessary for, often complex, concepts to become reality
4. Ability to seek to achieve sustainable solutions to problems and have strategies for being creative and innovative
5. 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

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

2. Apply problem solving skills, information retrieval, and the effective use of general IT facilities
  3. Communicate (written and oral; to technical and non-technical audiences) and work with others
  4. Awareness of the nature of business and enterprise in the creation of economic and social value
  5. Overcome difficulties by employing skills, knowledge and understanding in a flexible manner
  6. Ability to formulate and operate within appropriate codes of conduct, when faced with an ethical issue
  7. Appreciation of the global dimensions of engineering, commerce and communication
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## Study

### Study time

Type	Required
Lectures	20 sessions of 1 hour (13%)
Seminars	8 sessions of 1 hour (5%)
Supervised practical classes	6 sessions of 1 hour (4%)
Other activity	2 hours (1%)
Private study	114 hours (76%)
Total	150 hours

### Private study description

114 hours guided independent learning

### Other activity description

2x1hours example classes

## 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.

### Assessment group D4

	Weighting	Study time	Eligible for self-certification
<b>Assessment component</b>			
Oral Presentation	40%		No
Oral presentation (10 minutes)			

Reassessment component is the same

#### Assessment component

Online Examination	60%		No
QMP			
~Platforms - AEP,QMP			

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

Reassessment component is the same

## Feedback on assessment

Coursework: individual feedback returned, and 1h feedback session for the whole class after return of the coursework.

Examination: publication of recent past examination papers and model solutions or mock paper and solutions where past papers do not exist. Cohort level feedback on examinations.

[Past exam papers for ES4E3](#)

## Availability

### Pre-requisites

To take this module, you must have passed:

- All of

- [ES2C2-15 Civil Engineering Design 1](#)
- [ES2C3-15 Civil Engineering Materials and Structural Analysis](#)
- [ES3D1-15 Concrete Structures](#)
- [ES3D2-15 Steel Structures](#)
- [ES3E2-15 Civil Engineering Design II](#)

## **Courses**

This module is Optional for:

- Year 4 of UESA-H116 MEng Engineering with Exchange Year