ES4E3-15 Structural Dynamics and Vibration

23/24

Department
School of Engineering
Level
Undergraduate Level 4
Module leader
Stana Zivanovic
Credit value
15
Module duration
10 weeks
Assessment
30% coursework, 70% exam
Study location
University of Warwick main campus, Coventry

Description

Introductory description

ES4E3-15 Structural Dynamics and Vibration

Module aims

To explore the principles of structural dynamics and vibration serviceability assessment of civil engineering structures.

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 and vibration 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
- Principles of vibration serviceability assessment of structures such as footbridges, floors, stadia and stairs
- Understanding and applying design guidance
- Design of vibration suppression solutions (e.g. tuned-mass dampers)

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 vibration serviceable designs of modern (slender, light, lightly-damped and vibration sensitive) civil engineering structures and critically evaluate their relative importance.
- Critically assess uncertainties associated with loading estimates and vibration predictions by analysing an advanced experimental setup on a as-built structure.
- 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, vibration suppression solutions and performance of relevant vibration serviceability design guidelines.

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	2 sessions of 1 hour (1%)
Practical classes	1 session of 6 hours (4%)
Other activity	8 hours (5%)
Private study	114 hours (76%)
Total	150 hours

Private study description

114 hours guided independent learning

Other activity description

8x1hours example classes

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group D6

	Weighting	Study time	Eligible for self-certification
Assessment component			
Coursework - Written Report Students critically analyse the data collected during the lab work.(6 pages).	30%		Yes (extension)
Reassessment component is the same			
Assessment component			
Written Examination Traditional written exam	70%		No

- Answerbook Pink (12 page)
- 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 Core optional for:

- Year 4 of UESA-H219 MEng Civil Engineering with Exchange Year

This module is Optional for:

- Year 4 of UESA-H116 MEng Engineering with Exchange Year
- Year 5 of UESA-H115 MEng Engineering with Intercalated Year

This module is Option list A for:

- Year 4 of UESA-H217 MEng Civil Engineering
- Year 5 of UESA-H218 MEng Civil Engineering with Intercalated Year
- Year 4 of UESA-H114 MEng Engineering