GHENT UNIVERSITY

Course Specifications

From the academic year 2024-2025 up to and including the academic year

Mechanical Vibrations (E040670)

Course size *(nominal values; actual values may depend on programme)*

Credits 6.0 **Study time 180 h**

Course offerings and teaching methods in academic year 2024-2025

A (semester 2)	Dutch	Gent	
B (semester 2)	English	Gent	lecture seminar

Lecturers in academic year 2024-2025

Loccufier, Mia	TW08	lecturer-in-charge

Offered in the following programmes in 2024-2025	crdts	offering
Bridging Programme Master of Science in Electromechanical Engineering(main subject Control Engineering and Automation)	6	B
Bridging Programme Master of Science in Electromechanical Engineering(main subject Electrical Power Engineering)	6	B
Bridging Programme Master of Science in Electromechanical Engineering(main subject Maritime Engineering)	6	B
Bridging Programme Master of Science in Electromechanical Engineering(main subject Mechanical Construction)	6	B
Bridging Programme Master of Science in Electromechanical Engineering(main subject Mechanical Energy Engineering)	6	B
Master of Science in Electromechanical Engineering(main subject Control Engineering and Automation)	6	A
Master of Science in Electromechanical Engineering(main subject Control Engineering and Automation)	6	B
Master of Science in Electromechanical Engineering(main subject Electrical Power Engineering)	6	A
Master of Science in Electromechanical Engineering(main subject Electrical Power Engineering)	6	B
Master of Science in Electromechanical Engineering(main subject Maritime Engineering)	6	A
Master of Science in Electromechanical Engineering(main subject Maritime Engineering)	6	B
Master of Science in Electromechanical Engineering(main subject Mechanical Construction)	6	A
Master of Science in Electromechanical Engineering(main subject Mechanical Construction)	6	B
Master of Science in Electromechanical Engineering(main subject Mechanical Energy Engineering)	6	A
Master of Science in Electromechanical Engineering(main subject Mechanical Energy Engineering)	6	B
International Master of Science in Advanced Design of Sustainable Ships and Offshore Structures	6	B

Teaching languages

English, Dutch

Keywords

vibrations analysis, structural and machine dynamics

Position of the course

This course studies the dynamic response of mechanical structures to dynamic loads. The course emphasizes the important fundamental concepts to perform the dynamical analysis of elastic structures such that an optimal design can be

obtained, passive control devices can be designed and industrial experiments and software packages can be understood.

Contents

- Introduction: Dynamic behaviour of mechanical structures and machines
- Modelling: Lagrange's equations
- Linear models
- Systems with one degree of freedom: Free vibration-energy method, Forced vibration, Harmonic vibrations, Random vibrations,
- Dynamic loads: unbalance, vortex shedding, mulit-cylinder machines
- Modal analysis: Vibration modes of undamped, proportional damped and non-proportional damped systems, Earthquake response
- Harmonic vibrations
- Passive vibration control: vibration isolation, Vibration absorbers
- Experimental modal analysis: SDOF methods, MDOF methods
- Rayleigh-Ritz theory: Rayleigh's quotient-Rayleigh-Ritz method, Model reduction
- Selfinduced vibrations
- Continuous systems: axial vibration, torsional vibration, transverse vibration
- Introduction of rotordynamics

Initial competences

Classic mechanics and mechanics of materials.

Final competences

1 Modelling of rotating and non-rotating mechanical systems based on Langrange's technique.
2 Calculate vibration levels of mechanical structures subjected to dynamic loads.
3 Perform a modal analysis and formulate structural modifications for continuous and discrete systems.
4 Design of vibration isolation and vibration absorption devices.
5 Identify modal parameters from an experiment
6 Apply model structure preserving reduction techniques.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Seminar, Lecture, Practical, Independent work

Study material

Type: Syllabus

Name: Mechanical Vibrations
Indicative price: € 12
Optional: no
Language : English
Number of Pages : 240
Available on Ufora : Yes
Online Available : Yes
Available through Student Association : Yes

References

- Mechanical Vibrations, S. Rao, Prentice-Hall, 2005.
- Rotating Machinery Vibration: From Analysis to Troobleshooting, M.L. Adams, Marcel Dekker Inc., 2000.
- Harris' Shock and Vibration Handbook, C. M. Harris and A. G. Piersol, McGraw-Hill, 2002.
- Modal testing, theory and practice, D.J. Ewins, John Wiley and Sons, New York, 2000.
- Mechanical Vibrations, J.P. Den Hartog, Dover publications, Inc. New York, 1984.

Course content-related study coaching

Assessment moments

end-of-term and continuous assessment

Examination methods in case of periodic assessment during the first examination period

Oral assessment, Written assessment

Examination methods in case of periodic assessment during the second examination period

Oral assessment, Written assessment

Examination methods in case of permanent assessment

Assignment

Possibilities of retake in case of permanent assessment

examination during the second examination period is possible

Extra information on the examination methods

Permanent evaluation
The permanent evaluation concerns the execution of measurements and the answering of corresponding questions. The results are handed in as a report.
During examination period:
The oral exam part is a questioning based on a written preparation.
The written exam part is an open-book exam on problems.

Calculation of the examination mark

permanent evaluation: 4 of 20
oral exam part: 8 of 20
written exam part: 8 of 20
The result of the permanent evaluation can be transferred to the second examination period.