Tárgytematika / Course Description
Vibrations

GKNB_AMTA005

Tárgyfelelős neve / Teacher's name: dr. Pidl Renáta Rita

Félév / Semester: 2024/25/1

Beszámolási forma / Assesment: Vizsga

Tárgy heti óraszáma / Teaching hours(week): 2/2/0

Tárgy féléves óraszáma / Teaching hours(sem.): 0/0/0

OKTATÁS CÉLJA / AIM OF THE COURSE

This course deals with the study of vibration in mechanical systems which is concerned with the oscillatory motions of bodies and the forces associated with them. This course aims to provide you with an understanding of the nature and behaviour of dynamic engineering systems and the capability of applying the knowledge of mathematics, science, and engineering to solve engineering vibration problems.

Upon successful completion of this course, you should be able to

develop the mathematical model of dynamic systems with single degree of freedom (SDOF) and multi degree of freedom (MDOF),

calculate the natural frequencies and period of simple vibrating mechanical systems,

obtain the analytical solution for system's time- and frequency domain,

deal with engineering systems involving vibration isolation and vibration of beams.

TANTÁRGY TARTALMA / DESCRIPTION

Week 1	Overview of mathematical apparatus used in vibrations (complex numbers, matrix algebra). Basic fundamentals of vibration: spring, damping, excitation. Classification of vibrations.
Week 2	Stiffness determination of the most commonly used springs. Setting up the differential equation of motion of linear SDOF systems utilizing Lagrange's equations of motion of second kind.
Week 3	Equivalent mass, -stiffness and -damping. Overview of most commonly used exitations (force input, moment input, base motion input).
Week 4	Analytical solution of equation of motion in case of undamped, free, linear SDOF systems. Calculation of natural frequencies.
Week 5	Analytical solution of equation of motion in case of damped, free, linear SDOF systems. Under-, critical-, and over damping. Logaritmic decrement.

Week 6	Analytical solution of equation of motion in case of damped, excited, linear SDOF systems – response in the time domain.
Week 7	Linear SDOF systems: Response in the Frequency Domain. Amplitude and phase diagrams of frequency response functions. **Mid-term written exam 1**
Week 8	Vibration isolation.
Week 9	Setting up the differential equation of motion of linear MDOF systems utilizing Lagrange's equations of motion of second kind.
Week 10	Analytical solution of equation of motion in case of undamped, free, linear MDOF systems. Natural frequencies and natural modes.
Week 11	Analytical solution of equation of motion in case of undamped, excited, linear MDOF systems – response in the time domain.
Week 12	Undamped, linear MDOF systems: response in the frequency domain. Transformation from global to modal coordinates.
Week 13	Continuum vibrations – natural frequencies and modes of longitudinal and torsional vibrations of uniform beams. **Mid-term written exam 2**
Week 14	Continuum vibrations – natural frequencies and modes of bending vibrations of uniform beams. **Complement exam**

SZÁMONKÉRÉSI ÉS ÉRTÉKELÉSI RENDSZERE / ASSESMENT'S METHOD

Attendance at lectures is not mandatory.

Exams:

There will be two mid-term written exams and one final written exam. The exams contain 80% calculating tasks and 20% theoretical tasks. The two mid-term exams will take 50-50 minutes and in each mid-term exam you can score 20-20 points which will count into the final exam score. You have to score at least 6 points from 40 in the two mid-term exams, otherwise you will not get the instructor's signature for the subject. If you did not score 6 points, you can complete it in the complement exam last week of the semester. You can not attend an exam due to a medical condition, certified by a doctor you can complete that exam in the complement exam but you must notify the instructor in advance. In the complement exam you can gain the instructor's signature if you score at least 6 point from 20. If you did not score at least 6 point in the two mid-term exam either in the complement exam you will not get the instructor's signature and you are not allowed to participate in the final exam. The final exam will take 100 minutes and you can score max. 40 points. Student who perfoms well in the mid-term exams, this means who score min. 30 points from 40, could get a final mark. This means if you score min. 30 point in the mid-term exams you will not have to participate the final exam.

30 - 35	good (4)
36 - 40	excellent (5)

In exams you are not allowed to use smartphones, notes, books, smartwatches. Students must complete the exams on their own. In each exam studets have to identify themselfves with identity card or driving licence.

Grading Policy:

Score	Mark

under 48	fail (1)
48 - 61	pass (2)
62 - 75	satisfactory (3)
76 - 90	good (4)
91 - 130	excellent (5)

KÖTELEZŐ IRODALOM / OBLIGATORY MATERIAL

Égert J. – Jezsó K.: Mechanics - Vibrations, Universitas-Győr Kht. 2006.

M. Csizmadia B. - Nándori E.: Mechanics for engineers – Dynamics, Nemzeti Tankönyvkiadó, 1999.

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

AJÁNLOTT IRODALOM / RECOMMENDED MATERIAL