Course unit title:	Mechanical Vibrations and Machine Dynamics		
Course unit code:	ME323		
Type of course unit:	Compulsory		
Level of course unit:	Bachelor (1st Cycle)		
Year of study:	3		
Semester when the unit is delivered:	5 (Fall)		
Number of ECTS credits allocated :	6		
Name of lecturer(s):	Dr. Marios Lestas		
Learning outcomes of the course unit:	1. Formulate and solve machinery vibrations problems. 2. Solve common machinery vibration problems using Matlab. 3. Report the most common machine faults and their main characteristics. 4. Solve problems regarding the vibration of beams on elastic foundations. 5. Solve problems regarding the stability of rotors on elastic shafts.		
Mode of delivery:	Face-to-face		
Prerequisites:	ME114, AMAT204	Co-requisites:	None
Recommended optional program components:	None		
Course contents:	• **Natural and forced vibration: Review:** state the physical principles of natural vibration, explain how a system responds to a harmonic excitation, explain how a system responds to a non-harmonic excitation. • **Lumped mass systems:** state the eigenvalue/eigenvector problem, implement modal analysis to decouple systems with multiple degrees of freedom, explain how damping can be implemented to the modal analysis, implement in matlab numerical methods to plot the response of a system and solve the eigenvalue/eigenvector problem. • **Continuous Systems:** List the differences of continuous systems with lumped mass systems through the study of rod and beam vibrations. • **Approximate and numerical methods:** explain the use of transfer matrices and their application to vibration analysis, explain the finite elements method. • **Rotor dynamics:** describe the dynamics of a rotor on a flexible shaft, compute the rotating unbalance and the critical speed, explain gyroscopic effects are how they affect the rotor dynamics, describe how viscous and hysteretic damping affect the dynamics of the system, explain the behaviour of rotors that are mounted on flexible bearings, explain the stability of rotors. • **Vibrating systems design:** Outline the general design problem in vibrating systems, compute the necessary mass to establish known motion balancing. • **Machinery vibration: monitoring and diagnosis:** Apply vibration analysis in the time domain, apply vibration analysis in the frequency domain, explain the time domain signal processing procedures, explain the frequency domain signal processing procedures. • **Laboratory work**, where students can apply their gained knowledge and evaluate practical problems for better comprehension		
Recommended and/or required reading:			
Textbooks:	S. S. Rao, ***Mechanical Vibrations***, Prentice Hall, 5th edition, 2010. A. Dimarogonas, ***Vibration for Engineers***, Prentice Hall, 1996.		

References:	D. J. Inman, ***Engineering Vibration***, Prentice Hall, 4th edition, 2013. L. Meivovitch***, Principles and techniques of Vibrations***, Prentice Hall, 1997. J. H. Ginsberg, Mechanical ***and Structural Vibrations: Theory and Applications***, John Wiley & Sons, Inc., 2001. V. Wowk, ***Machinery Vibration: Alignment***, McGraw-Hill, 2000
Planned learning activities and teaching methods:	The taught part of course is delivered to the students by means of lectures, conducted with the help of computer presentations. Lecture notes and presentations are available through the web for students to use in combination with the textbooks. Furthermore, theoretical principles are explained by means of specific examples and solution of specific problems. Lectures are supplemented with laboratory work carried out with the supervision of a lab assistant. Here a demonstration of actual experimental problems takes place. Additionally, during laboratory sessions, students apply their gained knowledge and identify the principles taught in the lecture sessions.
Assessment methods and criteria:	• Assignments: 5% • Tests: 20% • Laboratory Work: 15% • Final Exam: 60%
Language of instruction:	English
Work placement(s):	No