Course Title	**Vibrations Theory and Applications**				
Course Code	**MME 426**				
Course Type	Technical Elective Course				
Level	Undergraduate				
Year / Semester	4th Year / 7th or 8th Semester				
Teacher's Name	Andreas Kyprianou				
ECTS	6	Lectures / week	3+1 hours	Laboratories / week	0
Course Purpose and Objectives	The purpose of this course is to extend the principles of vibration engineering to continuum and non-linear systems.				
Learning Outcomes	• Recognizing the characteristic features of multi-degree of freedom systems and infinite degree of freedom systems. • Application to vibration absorption. • Recognizing the characteristic features of infinite degree of freedom systems. • Modelling using ordinary and partial differential equations. • Simple qualitative and quantitative analysis of non-linear systems. • Applications of non-linear systems to population growth rate and LASER emission.				
Prerequisites	MME 227	Required	None		
Course Content	This course studies the vibrations of linear systems consisting of finite multiple and infinite degrees of freedom. The theory of vibration absorption as generated by the basic theory of linear multi-degree of freedom systems is analyzed in its full detail. The partial differential equations describing the behavior of infinite degree of freedom systems are derived from the basic principles of strength of materials. The distinctive qualitative and quantitative characteristics of non-linear systems are described and subsequently and subsequently the methodology of extracting them for simple non-linear systems is presented. Topics studied: structure of dynamics and dynamical examples from various scientific disciplines, generalized coordinates, vibrations of multi-degree and infinite degree of freedom systems, non-linear system behaviour characterization: limit cycles, bifurcations and chaos.				
Teaching Methodology	• Lectures • Problem exercises • Concise and extensive study of a relevant scientific article • Computational solution of differential equations • Communicative, Collaborative • During the first week of the semester the students receive the course syllabus, which includes the course content, bibliography, learning outcomes, assessment and office hours.				

Bibliography	• Bishop, R.E.D. and D.C. Johnson, *The mechanics of Vibration*. Cambridge University Press. • Kaplan, D. and L. Glass, *Understanding Non-linear Dynamics*. Springer. • Rao, S.S., *Mechanical Vibrations*. Pearson. • Strogatz, S.H., *Non-linear Dynamics and Chaos, with Applications to Physics, Chemistry, and Engineering*. CRC Press. • Weaver, W., S.P. Timoshenko and D.H. Young, *Vibration problems in Engineering*. Wiley.
Assessment	• Homework 5% • Midterm exam 25% • Final exam 50% • Analysis of a scientific article 20%
Language	Greek