ENGINEERING FOR SAFETY OF CRITICAL INDUSTRIAL AND CIVIL

(Lecce - Università degli Studi)

Teaching DYNAMICS AND STABILITY OF MECHANICAL SYSTEMS

GenCod A007227

Owner professor NICOLA IVAN GIANNOCCARO

Reference professors for teaching NICOLA IVAN GIANNOCCARO, MICHELE SCARAGGI

Teaching in italian DYNAMICS AND STABILITY OF MECHANICAL SYSTEMS

Teaching DYNAMICS AND STABILITY OF MECHANICAL SYSTEMS

SSD code ING-IND/13

Reference course ENGINEERING FOR SAFETY OF CRITICAL INDUSTRIAL AND

Course type Laurea Magistrale

Credits 6.0

Teaching hours Front activity hours: 54.0

For enrolled in 2023/2024

Taught in 2023/2024

Course year 1

Language ENGLISH

Curriculum INDUSTRIAL ENGINEERING SYSTEMS

Location Lecce

Semester Second Semester

Exam type Oral

Assessment Final grade

Course timetable https://easyroom.unisalento.it/Orario

BRIEF COURSE DESCRIPTION

DYNAMICS AND STABILITY OF MECHANICAL SYSTEMS

Detailed program

Dynamics: Lagrangian, momentum and energy conservation.
Rigid body and multi-body dynamics: Theory and computer-aided applications to complex mechanical systems

Vibration dynamics of single degree of freedom (SDOF) systems: Theory of free and forced vibrations, with dissipation.
SDOF Vibration dynamics: Applications to constraint oscillations, rotating eccentric mass.Damping identification methods: logarithmic decrement, resonance curve sharpness**.** Equations of motion of the vibrating system with a free and constrained degree of freedom. Free undamped vibrations
Applications constraint oscillations, rotating eccentric mass, application. Definition of the response of mechanical systems to periodic forcing, the definition of the harmonic transfer function. Damping identification methods: logarithmic decrement, resonance curve sharpness.

Equations of Motion of a Mechanical System.
Modeling of a system, types of inputs, solutions with Laplace transforms, transforms of elementary functions, properties of Laplace functions, concept of transfer function. Study of the frequency response, Bode diagram of elementary functions, outline of linearization procedures, algebra of block diagrams.: Equilibrium position stability analysis and dynamic stability analysis. Frequency response function.

Dynamic behavior of the controlled mechanical system.
Concept of regulation system, typical structure of a regulation system, error indexes, fundamental regulations (P,PI,PID). Transmitters and receivers, examples of controlled devices.
Adjustment of the machine with a single degree of freedom. Stability of controlled and uncontrolled mechanical systems

REQUIREMENTS	Knowledge of the fundamentals of Analytical and Applied Mechanics are necessary.
COURSE AIMS	The course aims: -to provide basic knowledge about the dynamic behavior of a mechanical system with n degrees of freedom equipped with a possible control system and the methods necessary to address the main engineering problems related to the definition of the dynamic response of these systems, both controlled and uncontrolled. -to introduce a systematic approach to the writing of the equations of motion, for systems with 1 and 2-n degrees of freedom, ie to the development of the mathematical model capable of defining the dynamic behaviour. To provide the knowledge necessary for the study of dynamic stability for systems with one degree of freedom subject to force fields and introduction of the control action as a force field. -to provide the necessary knowledge for the regulation of single-degree-of-freedom machines and for the proportional derivative control of mechanical systems.
TEACHING METHODOLOGY	Frontal lectures, with the support of multimedial content and with the adoption of CAE software for multibody simulations.
ASSESSMENT TYPE	Oral exam.
REFERENCE TEXT BOOKS	*Giorgio Diana, Federico Cheli*, **Dinamica dei sistemi meccanici**, Editore: Polipress, Anno edizione: 2010, ISBN: 97888-7398-065-0