Mechanics Field		Structural Mechanics 2	Total of teaching hours : 92 hrs		
			Course	Supervised work	Lab work
GM I3.6	3 ECTS credits		42 hrs	12 hrs	
			4 hrs evaluation + 22 hrs individual work		

Structural Mechanics 2 : Methods for solving Statics and Dynamics problems

Objectives

- Learn how to put a problem of linear elasticity into equations and learn how to implement a resolution method. Learn the basic principles of the method of finite elements applied to the matrix calculus of structures, the formulation and properties of the elements used.
- Be able to use computer calculation tools in Mechanical Engineering.
- Understand and learn to describe the concepts of frequencies and own modes, and depreciation.

(taxonomic level : application and analysis)

Pre-requisites and links to other modules

- Dynamics of the non-deformable solid : matrix of inertia, Fundamental Principle of Dynamics
- System with a degree of freedom : free and forced oscillations, various cases of depreciation ($0<\xi<1$, $\xi=1$, $\xi>1$)
- Module GM 13-5

Calculation methods in elasticity Indicative duration : 14 hrs	○ Method of displacement (Navier's equations) ○ Methods of constraints (Beltrami's equations) ○ Special cases: flat deformations, flat constraints, Airy's function, concentration of constraints ○ Thermo-elasticity : Hooke's law equations - Duhamel
Method of Finite Elements applied to Structural Mechanics Indicative duration : 14 hrs	○ General presentation ○ Continuous environments and discrete structures : the concept of finite element, elementary and global, Principle of Virtual Works ○ Matrix writing of structural mechanics : equilibrium equations, generalised Hooke's law, relations between deformation and displacement, energy from deformation ○ Matrix of rigidity and matrix equilibrium equations of nodes F=Ku: elementary level, assembling of matrices, setting up on a system of springs ○ 1D elements (bar, beam) ○ 2D elements (membranes, plates and shells) ○ 3D elements ○ Modelling and mesh (practical advice) • General recommendations • Fineness of the mesh • Continuity • Rigid body movements
Introduction to Structure Dynamics Indicative duration : 16 hrs	○ System with a degree of freedom : reminders, bandwidth, transfer function, resolution of the differential equations of the movement, viscous and structural depreciations ○ Lagrange's equations ○ System with two degrees of freedom ○ System with n degrees of freedom • Putting into equations of movement (Basic Principle of Dynamics, Lagrange's equations) • Putting into equations by the Method of Finite Elements • Reminder : matrix of straightness