CT4140	Dynamics of Structures	4

Instructor	**Andrey Metrikine**
Education Period	3rd Education Period
Exam Period	3rd Exam Period
Course Language	English
Course Contents	Introduction. Challenging dynamic problems of modern civil engineering; Types and sources of dynamic loading on structures; Dynamic behavior of systems with 1 and 2 degrees of freedom revisited: main phenomena, introduction to the Fourier Analysis, aero-elastic instabilities (galloping and flutter). Vibrations of discrete systems with N degrees of freedom (N DOF). Derivation of equations of motion; Free vibrations of undamped N DOF systems: natural frequencies and normal modes, modal mass matrix and modal stiffness matrix, the Rayleigh method; Forced vibrations of undamped N DOF systems: Modal Analysis, the steady-state response to a harmonic load, the frequency-response function. Modal Analysis, Fourier Analysis, the steady-state response to a harmonic load of N DOF systems with viscous damping. Vibrations of one-dimensional (1D) continuous systems of finite length. Derivation of equations of motion for beam in bending, beam in shear, rod in axial motion, rod in torsion and taut cable; The boundary and interface conditions for continuous systems; Free vibrations of undamped 1D continuous systems: the method of separation of variables, natural frequencies and normal modes; Forced vibrations of 1D continuous systems (both with and without viscous damping): Modal Analysis, Fourier Analysis, the steady-state response to a harmonic load. Waves of one-dimensional (1D) continuous systems. Excitation, propagation, reflection and transmission of pulses in cables and rods; Harmonic waves and representation of traveling pulses as the superposition of the harmonic waves; Dispersion Analysis; The steady-state response of piles and rails to harmonic loads.
Study Goals	The goal of this course is to introduce various dynamic models of structures and to acquaint the students with the main ideas and methods of structural dynamics.
Education Method	Lectures
Course Relations	CT 4140 is strongly based upon CT2022 and CT 3110
Literature and Study Materials	Mandatory Material: 1. Spijkers J.M.J., Vrouwenvelder, A.C.W.M., Klaver E.C., Structural Dynamics; Part 1: Structural Vibrations. Lecture Notes CT 4140. 2. Metrikine, A.V., Vrouwenvelder, A.C.W.M., Structural Dynamics; Part 2: Wave Dynamics. Lecture Notes CT 4140. 3. Lecture Slides (available on Blackboard)
Assessment	Written open book exam.
Permitted materials during tests	Consulting any written text brought in by the students is permitted during the exam; although texting (as well as talking) by mobile phone is prohibited.
Judgement	Based on the result of the written exam.