STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Structural Dynamics		**1010102121010113741**
Field of study	Profile of study (general academic, practical)	Year /Semester
Structural Engineering Second-cycle Studies	**general academic**	**1 / 2**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
-	**Polish**	**obligatory**
Cycle of study:	Form of study (full-time,part-time)	
Second-cycle studies	**full-time**	
No. of hours		No. of credits
Lecture: **30** Classes: **15** Laboratory: **30** Project/seminars: **-**		**5**
Status of the course in the study program (Basic, major, other)	(university-wide, from another field)	
other	**university-wide**	
Education areas and fields of science and art		ECTS distribution (number and %)
technical sciences		**5 100%**
Technical sciences		**5 100%**

Responsible for subject / lecturer:

prof. dr hab. inż. Roman Lewandowski, prof. nadzw.
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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Students have known the integral and differential calculus and the matrix analysis. Students have known methods of static analysis of structures. Students have known a basis of dynamic analysis.
2	**Skills**	Students are able to calculate integrals and derivatives and are able to solve ordinary differential equations. Students are able to do operations on vectors and matrices, are able solve a set of linear algebraic equations and solve the linear eigenvalue problem. Students are able to perform the static analysis of structures.
3	**Social competencies**	Students are able to clearly describes and presents results of own works.

Assumptions and objectives of the course:

The aim of lectures is to acquaint students with modern methods of dynamic analysis of structures.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Students have known methods of dynamic analysis of complex structures (in the linear range) - [[K_W03]]
2. Students have known methods of dynamic analysis of frame structures with main types of dampers - [[K_W03]]
3. Students have known a basis of design sensitivity analysis of fundamental quantities describing dynamics of structures - [[K_W03]]
4. Students have known a basis of analysis of seismically excited structures (in a linear range) - [[K_W03]]

Skills:

1. Students are able to perform typical dynamic calculation of frame structures in linear range - [[K_U004]]
2. Students are able to define a computer model of typical frame structures loaded by dynamic forces - [[K_U004]]
3. Students are able to critically check results of dynamic analysis of structures - [[K_U004]]

Social competencies:

1. Students are aware of responsibility for results of performed calculation - [[K_K02]]
2. Students are able to describe results of performed calculation and are able to formulate appropriate conclusions - [[K_K02]]

Assessment methods of study outcomes
Written tests, valuation of project, written and oral exam

Course description
Equations of motion of structures treated as discrete systems. Equations of motion written in terms of state variables. Models of chosen types of structures. Damping models. Free vibration analysis, dynamic characteristics of structures with and without damping. Sensitivities of natural frequencies and modes of vibration with respect to design parameters. Analysis of steady state vibration. Normal coordinates and theirs applications. Rayleigh quotients. Computer methods of solution of eigenvalue problems. Time integration methods. Dynamic analysis of block foundations. Tuned mass damper. Analysis of structures seismically and para-sejsmically excited. Introduction to random vibration.

Basic bibliography:

1. Structural dynamics for structural engineers, Hart G.C., Wong K.: , Wiley,, New York, 2000
2. Dynamika konstrukcji budowlanych, Lewandowski R., Wydawnictwo PP, Poznań, 2006
3. Structural dynamics. Theory and computation, Paz M., Chapman and Hall, New York, 1997
4. Computational methods in structural dynamics, Meirovitch L., Sjthoff and Noordhoff, Alpen aan dej Rein, 1980

Additional bibliography:

1. Dynamics of structures, Clough R.W., Penzien J.: , McGraw-Hill,, New York, 1993
2. Dynamics of structures, HumarJ.L.: , Balkema,, Lisse, 2000
3. Podstawy dynamiki budowli, Chmielewski T., Zembaty Z.: , Arkady, Warszawa, 1999

Result of average student's workload

Activity	**Time (working hours)**
1. Participation in lectures	75
2. Preparation of project	30
3. Preparation to the test and exam	30

Student's workload

Source of workload	**hours**	**ECTS**
Total workload	132	5
Contact hours	80	3
Practical activities	75	3