STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Dynamics of Bridges		**1010102121010110363**
Field of study: **Civil Engineering Second-cycle Studies**	Profile of study (general academic, practical): **general academic**	Year /Semester: **1 / 2**
Elective path/specialty: **Bridges and Underground Engineering**	Subject offered in: **Polish**	Course (compulsory, elective): **obligatory**
Cycle of study: **Second-cycle studies**	Form of study (full-time,part-time): **full-time**	
No. of hours: Lecture: **15** Classes: **15** Laboratory: **15** Project/seminars: **-**		No. of credits: **3**
Status of the course in the study program (Basic, major, other): **major**	(university-wide, from another field): **from field**	
Education areas and fields of science and art: **technical sciences** **Technical sciences**		ECTS distribution (number and %): **3 100%** **3 100%**

Responsible for subject / lecturer:

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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. Students are able to perform dynamic analysis of one degree of freedom system.
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 bridge structures.

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

Knowledge:

1. Students have known methods of dynamic analysis of structures with many degrees of freedom - [[K_W01]]
2. Students have known methods of determination of dynamic characteristics of structures - [[K_W01]]
3. Students have known methods of analysis of steady state and transient vibration - [[K_W01]]
4. Students have known methods of design sensitivity analysis of bridge structures loaded by dynamic forces - [[K_W01]]
5. Students have a basis knowledge about dampers - [[K_W01]]

Skills:

1. Students are able to derive the motion equation of typical dynamic systems - [[K_U004]]
2. Students are able to determine dynamic characteristics of structures - [[K_U004]]
3. Students are able to perform analysis of steady state and transient vibration - [[K_U004]]

Social competencies:

1. Students are aware of responsibility for results of performed calculation ? [K_K02] - [[K_K02]]
2. Students are able to critically check results of calculation - [[K_K02]]
3. Students are able to describe and present results of performed dynamic calculation - [[K_K02]]

Assessment methods of study outcomes
Written tests, valuation of project.
Course description
Discretization of structures, degree of freedom. Equations of motion of structures treated as discrete systems. Application of FEM to modeling of structures. Equations of motion written in terms of state variables. Damping models. Analysis of free vibration, dynamic characteristics of structures with and without damping. Sensitivities of natural frequencies and modes of vibration with respect to design parameters. Normal coordinates and theirs applications. Time integration methods. Dynamic analysis of bridges loaded by moving forces. Rayleigh?s quotient. Computer method of solving eigenvalue problem. Tuned mass damper.
Basic bibliography:
1. Dynamika konstrukcji budowlanych, Lewandowski R., Wyd. Pol. Poznańskiej, Poznań, 2006
2. Podstawy dynamiki budowli, Chmielewski T., Zembaty Z.: , Arkady, Warszawa, 1999
3. Structural dynamics for structural engineers, Hart G.C., Wong K.: , Wiley,, New York, 2000
Additional bibliography:
1. Dynamics of structures, Clough R.W., Penzien J.: , McGraw-Hill,, New York, 1993
2. Structural dynamics for structural engineers, Hart G.C., Wong K.: , Wiley,, New York, 2000
3. Dynamics of structures, HumarJ.L.: , Balkema,, Lisse, 2000
4. Structural dynamics. Theory and computation, Paz M., Chapmann and Hall, New York, 1997

Result of average student's workload

Activity	Time (working hours)
1. Participation in lectures	45
2. Preparation of project	20
3. Preparation to the test	15

Student's workload

Source of workload	hours	ECTS
Total workload	75	3
Contact hours	55	2
Practical activities	35	1