Code	VII.2.
Course Title (English)	Engineering Design V
Course Title (Polish)	Konstrukcja i eksploatacja maszyn oraz grafika inżynierska V
Credits	3 ECTS

Language of instruction   **English**

Programme   Computer Modelling and Simulation, Intelligent Energy, Biotechnology for Environmental Protection, Business and Technology

Type of studies   BSc studies

Unit running the programme   Institute of Mechanics and Machine Design Fundamentals

Course coordinator and *academic teachers*   **Prof. Bogdan Posiadała,** Prof. Dawid Cekus, Dr Paweł Waryś

Form of classes and number of hours

Semester	Lec.	Tut.	Lab.	Proj.	Sem.	Credit points
6	15	-	45	-	-	3

Learning outcomes   Theoretical knowledge of formulation and solution of statics problems and free vibrations of basic machine parts using finite element method (COSMOS/M software). The students will be able to perform on their own the analysis of strength and free vibrations of models of machine parts, draw conclusions important from the point of view of design and operation. The students will be aware of the role of proper machine design for the comfort of the society. They will also know how to cooperate in a small team.

Prerequisites   Basic computer skills. Knowledge of safety rules for computer's users.

Course description   LECTURE

Literature. General rules of creation of computational models of the real objects - one, two or more degrees of freedom models.
Modeling of dynamics of machine element and units. The continuous model of the frame and the frame coupled with the harmonic oscillator.
Discrete, continuous and continuous-discrete dynamical models. Determining of equivalent mass and stiffness.
The initial problem formulations and solutions by the use of the Runge-Kutta method of the fourth order.
Sample cases of initial problem solution by use of computer calculation packages.

Free vibration problems of the complex systems consisting of continuous elements like: bars, beams connected with discrete elements like: mass, spring, linear oscillator. The Lagrange's multipliers method of formulation and solution.

Modeling of kinematics and dynamics of mechanical systems – sample cases of machines: truck crane with the carried load and forest crane with the carried load

TUTORIALS:

Not applicable

LABORATORY

The introduction task illustrating the procedure of formulation and solution of engineering task by using finite element method systems e.g. COSMOS/M.

Computation models of beams and solution of static strength and free vibration problems.

Computation models of coupled mechanical systems modeling real objects and solution of static strength and free vibration problems.

Engineering tasks to check the knowledge and skills obtained during the course.

Computation FEM model of frame with attached linear oscillator. Static and dynamic analysis of the modeled system.

Computation discrete model of frame with attached linear oscillator. Analysis of free and forced vibration problem.

Engineering tasks to check the knowledge and skills obtained during the course.

PROJECT
Not applicable

SEMINAR
Not applicable

Form of assessment   Written partial tests.

Basic reference materials	1.	COSMOS/M - Finite element analysis system, version 1.75, *Structural Research & Analysis Corporation*, 1995.
	2.	Piszczek K., Walczak J.: Drgania w budowie maszyn, *PWN,* Warszawa, 1982.
	3.	Rusiński E.: Metoda elementów skończonych. System COSMOS/M., *Wydawnictwa Komunikacji i Łączności,* Warszawa, 1994.
	4.	Skalmierski B.: Mechanika, *PWN,* Warszawa, 1994.
	5.	Posiadała B. (red.), Kukla S., Przybylski J., Sochacki W., Tomski L.: Modelowanie i badania zjawisk dynamicznych wysięgników teleskopowych i żurawi samojezdnych, *WNT*, Warszawa, 2000.
	6.	Posiadała B. (red.), Geisler T., Policiński J., Sochacki W.: Rysunek techniczny w AutoCADzie, *Wydawnictwo Politechniki Częstochowskiej*, Częstochowa, 2002.
	7.	Posiadała B. (red.), Cekus D., Geisler T., Kukla S., Przybylski J., Sochacki W., Wilczak R.: Modelowanie, identyfikacja modeli i badania dynamiki żurawi samojezdnych, *WNT*, Fundacja Książka Naukowo-Techniczna, Warszawa, 2005.
	8.	Posiadała B. Modelowanie i analiza drgań ciągło-dyskretnych układów mechanicznych. Zastosowanie formalizmu mnożników Lagrange'a, *Wydawnictwo Politechniki Częstochowskiej*, Seria Monografie nr 136, 2007.

Other reference materials   None.

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Average student workload (teaching hours + individ.)	4 hours of teaching hours + 2 hours of individual work per week
Remarks:	
Updated on 31.01.2015	