

## SUBJECT CARD

Name in Polish: **Modelowanie układów wielocząłonowych**

Name in English: **Modelling of multibody systems**

Main field of study (if applicable): **Mechanical Engineering and Machine Building**

Specialization (if applicable):

Level and form of studies: **II level, full-time**

Kind of subject: **obligatory**

Subject code: **MMM041001**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)				30	
Number of hours of total student workload (CNPS)				60	
Form of crediting				Crediting with grade	
Group of courses					
Number of ECTS points				2	
including number of ECTS points for practical (P) classes				2	
including number of ECTS points for direct teacher-student contact (BK) classes				1.4	

### PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge of the theory of machines and mechanisms
2. Ability to analyze the kinematics and kinetostatics of mechanisms

### SUBJECT OBJECTIVES

- C1. Understanding of building of discrete computational multibody models
- C2. Understanding the principles of planning research, taking into account the working conditions (kinematic excitations, dynamic excitations, forces, torques, masses in multibody dynamic analysis of computer systems
- C3. Ability to critically assess the results of simulations of machinery in computer systems for dynamic analysis

## SUBJECT EDUCATIONAL EFFECTS

### **I. Relating to knowledge:**

### **II. Relating to skills:**

PEK\_U01 - Ability to apply professional computer system for simulating and analyzing dynamic multibody

PEK\_U02 - The ability to model the loads and the nature of work and the ability to analyze the mechanism of the results of the simulation of the multi-segment

PEK\_U03 - The ability to compute the kinematics and dynamics of selected groups of mechanisms

### **III. Relating to social competences:**

PEK\_K01 - Acquires care about the aesthetics of the work, including projects and reports

PEK\_K02 - Knowledge of how to take responsibility for own work

## PROGRAMME CONTENT

Form of classes – Project		Number of hours
Proj1	An introduction to the principles of building a multibody models	2
Proj2	Basics of modeling mechanisms in the MD.Adams system - modeling links, kinematic pairs, kinematic excitations	3
Proj3	Basics of modeling mechanisms in the MD.Adams system - modeling loads and perform calculations and analysis of results	3
Proj4	The test of modeling multibody system	2
Proj5	Kinematic and kinetostatic analysis of linkage mechanisms - building virtual models	2
Proj6	The analysis of kinematic and dynamic properties of the linkage mechanism (project)	2
Proj7	Analysis of gears (normal, planetary and differential) - principles of construction of virtual model	2
Proj8	The analysis of kinematic and dynamic properties of the gears (project)	2
Proj9	Building models of manipulators - direct and inverse task of kinematics	2
Proj10	Simulation researches of manipulators (project)	2
Proj11	Building models of spatial mechanisms - constraints, excitations	2
Proj12	Modeling and simulations of spatial mechanisms (project)	3
Proj13	Modeling and simulations of spatial mechanisms - analysis of the results of calculations	3
		Total hours: 30

## TEACHING TOOLS USED

N1. problem discussion  
 N2. project presentation  
 N3. self study - preparation for project class  
 N4. report preparation

#### EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Project)

Evaluation (F – forming (during semester), P – concluding (at semester end))	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01, PEK_K02	building the virtual model - test
F2	PEK_U02, PEK_U03, PEK_K01, PEK_K02	report, defence of the report
$P = (1/5)F1 + (4/5)F2$		

#### PRIMARY AND SECONDARY LITERATURE

##### PRIMARY LITERATURE

- [1] Gronowicz A. i inni: Teoria maszyn i mechanizmów. Zestaw problemów analizy i projektowania. Oficyna wydawnicza PWr. Wrocław 2000.  
 [2] Gronowicz A.: Podstawy analizy układów kinematycznych. Oficyna wydawnicza PWr. Wrocław 2003.  
 [3] Frączek J., Wojtyra M.: Metoda układów wielocłonowych w dynamice mechanizmów. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2007.

##### SECONDARY LITERATURE

- [1] Miller S.: Teoria maszyn i mechanizmów. Analiza układów mechanicznych. Oficyna wydawnicza PWr. Wrocław 1996.  
 [2] Miller S.: Układy kinematyczne. Podstawy projektowania. WNT 1988.  
 [3] MD. Adams – Reference Manual, 2008

#### MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT **Modelling of multibody systems** AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Mechanical Engineering and Machine Building**

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_U01	K2MBM_U04	C1	Pr1 to Pr4	N1
PEK_U02, PEK_U03	K2MBM_U05, K2MBM_U09	C2, C3	Pr5 to Pr13	N1, N2, N3, N4

PEK_K01, PEK_K02	K2MBM_K03, K2MBM_K05	C2, C3	Pr5 to Pr13	N1, N2, N3, N4
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SUBJECT SUPERVISOR

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