

SUBJECT CARD

Name in Polish: **Dynamika maszyn roboczych i pojazdów**

Name in English: **Dynamics of working machines and vehicles**

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

Specialization (if applicable): **Machine Design and Operation**

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

Kind of subject: **obligatory**

Subject code: **MMM042103**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	20		10	20	
Number of hours of total student workload (CNPS)	60		30	30	
Form of crediting	Crediting with grade		Crediting with grade	Crediting with grade	
Group of courses					
Number of ECTS points	2		1	1	
including number of ECTS points for practical (P) classes			1	1	
including number of ECTS points for direct teacher-student contact (BK) classes	1.2		0.7	0.7	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Has basic knowledge of analytical mechanics, linear algebra and differential equations confirmed by completion of relevant courses at university level
2. Has basic knowledge of drive systems for machinery and vehicles
3. Has basic knowledge of the theory of vehicle movement

SUBJECT OBJECTIVES

- C1. Consolidate and increase knowledge of the dynamic phenomena occurring in the working machines and vehicles
- C2. Acquire skills to solve engineering problems related to the dynamics of working machines and vehicles
- C3. To gain the habit of caring about the aesthetics of the work, including projects and reports, and consolidate the awareness of second-degree graduate, as a future leader

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - has consolidated and expanded knowledge of dynamics of systems with one degree of freedom, many degrees of freedom and continuous

PEK_W02 - has expanded and consolidated knowledge of ways to minimize vibrations and the dynamics of working machines

PEK_W03 - has expanded and consolidated knowledge of vehicle dynamics

II. Relating to skills:

PEK_U01 - is able to apply the appropriate computational methods and appropriate computer programs for vibration analysis and dynamic phenomena in mechanical devices

PEK_U02 - is able to shape and modify the dynamic properties of working machines and vehicles according to the needs

PEK_U03 - is able to plan and carry out experiments for identifying some dynamic properties of various working machines and vehicles

III. Relating to social competences:

PEK_K01 - has expanded the competence in care about the aesthetics of the work, including projects and reports

PEK_K02 - has consolidated the awareness of second-degree graduate, as a future leader

PROGRAMME CONTENT

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Form of classes – Lecture		Number of hours
Lec1	Dynamics of mechanical linear systems with one degree of freedom	2
Lec2	Dynamics of mechanical linear systems with finite amount of degrees of freedom. Reduction of continuous systems to systems with few degrees of freedom.	2
Lec3	Classical and operational modal analysis	2
Lec4	Nonlinear dynamics - selected issues	1
Lec5	Classical methods of vibration isolation. Tuned mass damper	2
Lec6	Stochastic description of road surfaces irregularities	1
Lec7	Vertical dynamics of vehicles	2
Lec8	Longitudinal vehicle dynamics	2
Lec9	Dynamics and vibration in powertrain systems of vehicles and working machines	2
Lec10	Mitigation and damping of noxious vehicle movements	2
Lec11	Selected problems the dynamics of cranes	2
		Total hours: 20
Form of classes – Laboratory		Number of hours
Lab1	Experimental determination of the moments of inertia of machines and their components	2
Lab2	Identification of the dynamic model of crane girder with use of classical experimental modal analysis	2

Lab3	Testing of dynamic effects in the steering system of industrial vehicle	2
Lab4	Testing of a dynamic properties of pneumatic nonlinear vibroisolation system	2
Lab5	Testing of a effectiveness load sway damping system for overhead crane	2
		Total hours: 10
Form of classes – Project		Number of hours
Proj1	Analysis of the work of a given crane and familiarization with a norms refer to dynamic calculations of this type of machines	2
Proj2	Building a simple mathematical model that allows approximate analysis of selected dynamic phenomena occurring during the operation of a given crane	2
Proj3	Building a crane simulation model that takes into account, inter alia, rope flexibility and stiffness of the rail-wheel contact	2
Proj4	Simulation studies of selected dynamic phenomena occurring during crane operation. Interpretation of the results with respect to current standards	2
Proj5	Simulation studies of the impact of applied solutions on dynamics of virtual crane	2
Proj6	Analysis of construction and operating conditions of given industrial wheeled vehicle. Familiarization with selected standards referring to the dynamics of this type of machines	2
Proj7	Building a simple mathematical model that allows approximate analysis of selected dynamic phenomena occurring during the operation given industrial vehicle	2
Proj8	Building the simulation model of given industrial wheeled vehicle	2
Proj9	Simulation studies of selected phenomena and dynamic characteristics of an object such as: snaking, angular oscillations and dynamic stability	2
Proj10	Simulation studies the impact on the dynamics of the test vehicle different structural changes	2
		Total hours: 20

TEACHING TOOLS USED

- N1. laboratory experiment
- N2. self study - preparation for project class
- N3. self study - preparation for laboratory class
- N4. traditional lecture with the use of transparencies and slides
- N5. tutorials

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)

Evaluation (F – forming (during semester), P – concluding (at semester end))	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01÷PEK_W03	test

P = F1

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Laboratory)

Evaluation (F – forming (during semester), P – concluding (at semester end))	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U03, PEK_K01+PEK_K02	short tests, laboratory reports

P = F1

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_U02+PEK_U03, PEK_K01+PEK_K02	rating developed models and reports from the undertaken calculations and analysis

P = F1

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[1] Bereś W.: Dynamika pojazdów i maszyn roboczych ciężkich. Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 1983r.[2] Giergiel J.: Drgania Mechaniczne. Wydawnictwo AGH, Kraków 2000r.

SECONDARY LITERATURE

[1] Uhl T.: Komputerowo wspomagana identyfikacja modeli konstrukcji mechanicznych. WNT, Warszawa 1997r. [2] Kaliski S.: Drgania i fale. PWN, Warszawa 1986r.[3] Randall R. B., Tech B.: Frequency Analysis. Brüel and Kjaer 1987r.[4] Dudek D.: Elementy dynamiki maszyn górnictwa odkrywkowego. Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 1994r.[5] Dudziński Piotr: „Lenksysteme für Nutzfahrzeuge - Theorie und Praxis”, Springer 2005r.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Dynamics of working machines and vehicles
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_W01	K2MBM_KE_W02	C1	Lec1÷Lec4	4, 5
PEK_W02	K2MBM_KE_W02	C1	Lec5, Lec9, Lec11	4, 5
PEK_W03	K2MBM_KE_W02	C1	Lec6÷Lec10	4, 5
PEK_U01	K2MBM_KE_U01	C2	Pr1÷Pr10	2, 5
PEK_U02	K2MBM_KE_U01	C2	Pr5, Pr10	2, 5
PEK_U03	K2MBM_KE_U01	C2	La1÷La5	1, 3, 5
PEK_K01	K2MBM_K03	C3	La1÷La5, Pr1÷Pr10	5
PEK_K02	K2MBM_K07	C3	Pr1÷Pr10	2, 5

SUBJECT SUPERVISOR

dr inż. Andrzej Kosiara tel.: 71 320-23-46 email: Andrzej.Kosiara@pwr.edu.pl