Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Teoria mechanizmów i manipulatorów**
Name in English: **Theory of Mechanisms and Manipulators**
Main field of study (if applicable): **Mechanical Engineering and Machine Building**
Level and form of studies: **I level, full-time**
Kind of subject: **obligatory**
Subject code: **MMM031023 (MMM031323)**
Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30			30	
Number of hours of total student workload (CNPS)	60			90	
Form of crediting	Examination			Crediting with grade	
Group of courses					
Number of ECTS points	2			3	
including number of ECTS points for practical (P) classes				3	
including number of ECTS points for direct teacher-student contact (BK) classes	1.2			2.1	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge of mathematical analysis, matrix algebra
2. Knowledge of fundamental laws in statics, kinematics and dynamics
3. Skill in fuction analysis, derivatives, basic matrix and vector operations

SUBJECT OBJECTIVES

C1. Acquire knowledge in topology, kinematics and dynamics of mechanisms and manipulators
C2. Acquire and understanding of basic mechanisms and manipulators
C3. Getting skills in determining kinematic and dynamic parameters

SUBJECT EDUCATIONAL EFFECTS

I. Relating to knowledge:

PEK_W01 - Understands theoretical fundamentals of mechanism and robot topology
PEK_W02 - Has the knowledge of kinematic and dynamic analysis methods
PEK_W03 - Is able to commentate results of analysis, evaluate their correctness

II. Relating to skills:

PEK_U01 - Is able to evaluate topological carrectness of kinematic systems
PEK_U02 - Is able to determine kinematic and dynamic properties
PEK_U03 - Is able to create models of simple planar mechanisms and manipulators

III. Relating to social competences:

PEK_K01 - Has a conviction of responsibility for the work done

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Topology of mechanisms, movable properties, redundant constraints	3
Lec2	Kinematics of mechanisms - graphic-analytical methods	3
Lec3	Analytical methods in kinematics (vectors, projections, time derivatives)	2
Lec4	Planetary gear trains	2
Lec5	Manipulators' properties. Planar serial and parallel systems	2
Lec6	Kinematics of planar manipulators, jacobian	2
Lec7	Matrix description of spatial systems	2
Lec8	Denavit-Hartenberg notation	2
Lec9	Introduction to mechanisms' dynamics	2
Lec10	Kinetostatic analysis	3
Lec11	Friction in joints, efficiency	3
Lec12	Dynamic motion analysis	2
Lec13	Fluctuation o machine motion, flyweels	2
		Total hours: 30

Form of classes – Project		Number of hours
Proj1	Introduction to modelling mechanisms in SAM (Simulation and Analysis of Mechanisms) – presentation of examplesi	2
Proj2	Mechanisms' topology: rules of drawing digrams, topology analysis - joint classification, mobility (test, project)	2
Proj3	Rules of creating models in SAM system, creating simple models, model motion simulation, presentation of analysis results	2
Proj4	Dimensional modelling of mechanisms, drivers' definition, massis, external loads	2
Proj5	Kinematic analysis - position analysis (project)	2

Proj6	Kinematic analysis - velocity and acceleration determination - vector methods (test, project)	2
Proj7	Kinematic analysis - velocity and acceleration determination using SAM (project)	2
Proj8	Kinematic analysis using analytical methods: loop equation, vectors, projections, time derivatives (project)	2
Proj9	Planar manipulators - kinematic analysis using matrix notation	2
Proj10	Modelling manipulators in SAM: forward and inverse tasks (project)	2
Proj11	Anaysis of planetary transmissions, angular velocity ratio determination (test, project)	2
Proj12	Modelling of planetary transmissions and gear linkage mechanisms using SAM (project)	2
Proj13	Joint force and external equilibrium determination (test, project)	2
Proj14	Determination of joint forces including friction (test, project)	2
Proj15	Dynamic force analysis using SAM	2
		Total hours: 30

TEACHING TOOLS USED

N1. problem lecture
N2. self study - preparation for project class
N3. individual project
N4. tutorials
N5. preparation for examination

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_W02, PEK_W03	written examination
P = Ocena z egzaminu		

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_U02, PEK_U03	project defence

F2	PEK_U01, PEK_U02, PEK_U03 PEK_K01	test
P = średnia wszystkich ocen		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Gronowicz A.: Fundamentals of kinematic systems analysis (in Polish). Oficyna Wydawnicza PWr., Wrocław 2003; Morecki A., Knapczyk J., Kędzior K.: Theory of mechanisms and manipulators (in Polish). WNT 2002; Miller S.: Theory of machines and mechanisms. Analysis of mechanical systems (in Polish). Oficyna Wydawnicza PWr. Wrocław 1996; Gronowicz A. i inni: Theory of machines and mechanisms. Set of analysis and synthesis problems (in Polish). Oficyna Wydawnicza PWr. Wrocław 2002

SECONDARY LITERATURE

Olędzki A.: Fundamentals of machines and mechanisms theory (in Polish). WNT 1987; Morecki A., Oderfeld J.: Theory of machines and mechanisms (in Polish). PWN 1987; Waldron K., Kinzel G.: Kinematics, Dynamics and Design of Machinery. John Wiley &Sons, Inc. 1999

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Theory of Mechanisms and Manipulators
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, PEK_W02, PEK_W03	K1MBM_W17	C1, C2, C3	Lec1-Lec13	N1 - N5
PEK_U01, PEK_U02, PEK_U03	K1MBM_U11	C2, C3	Proj1-Proj15	N2, N3, N4
PEK_K01	K1MBM_K04	C3	Proj1-Proj15	N3

SUBJECT SUPERVISOR

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