

Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Koszty jakości**

Name in English: **Quality Costs**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Quality Management**

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

Kind of subject: **obligatory**

Subject code: **FBZ001189**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15				
Number of hours of total student workload (CNPS)	30				
Form of crediting	Crediting with grade				
Group of courses					
Number of ECTS points	1				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	0.6				

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

1. Knowledge of the basics of quality management.

### SUBJECT OBJECTIVES

- C1. Acquiring by the student the basic knowledge ensuring the ability to understand the economic issues related to quality management in business organisations.
- C2. Becoming acquainted with the issues concerning the importance of quality costs in business, the process approach to error flows (deviations from quality requirements) and their association with the risk of hazard to people and environment, the quality cost accounting, including the one based on activities.
- C3. Ability to evaluate the component parts of the costs related to quality and the way of analysing and monitoring them.

SUBJECT EDUCATIONAL EFFECTS

**I. Relating to knowledge:**

PEK\_W01 - systematised knowledge of the costs related to quality and their structure and of the ways of collecting information, analysing and monitoring

**II. Relating to skills:**

**III. Relating to social competences:**

PEK\_K01 - awareness of the significance of quality costs in business practice and in everyday life

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction to the economic issues related to quality management.	2
Lec2	Quality and quality costs.	2
Lec3	Evolution of the knowledge of quality costs.	2
Lec4	Quality management concepts taking account of quality costs.	2
Lec5	Structural and economic models of quality costs.	2
Lec6	Quality cost accounting.	2
Lec7	Quality costs related to product safety.	2
Lec8	Test.	1
		Total hours: 15

TEACHING TOOLS USED

- N1. informative lecture
- N2. multimedia presentation
- N3. problem lecture

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	test
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

PRIMARY LITERATURE:

[1] Zymonik Z., Koszty jakości w zarządzaniu przedsiębiorstwem, wydanie drugie poszerzone, Oficyna Wydawnicza Politechniki wrocławskiej, Wrocław 2003.

[2] Zymonik Z., Hamrol A., Grudowski P., Zarządzanie jakością i bezpieczeństwem, PWE, Warszawa 2012.

SECONDARY LITERATURE

SECONDARY LITERATURE:

[1] Bank, Zarządzanie przez jakość, Gebethner i Ska, Warszawa 1996.

[2] Dahlgaard J.J., Kristensen K., Kanji G.K., Podstawy zarządzania jakością, PWN, Warszawa 2001.

[3] Szczepańska K., Koszty jakości dla inżynierów, Wydawnictwo Placet, Warszawa 2009. Czasopisma; „Problemy Jakości”, Zarządzanie Jakością”.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Quality Costs**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_ZJ_W01, K2ZIP_ZJ_W04	C1, C2, C3	Lec1, Lec2, Lec3, Lec4, Lec5, Lec6, Lec7	N1, N2, N3
PEK_K01	K2ZIP_ZJ_K01, K2ZIP_ZJ_K02	C1, C3	Lec1, Lec2, Lec3, Lec4, Lec5, Lec6, Lec7	N1, N2, N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **BLOK KURSÓW HUMANISTYCZNYCH**

Name in English: **Block of humanistic courses**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable):

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

Kind of subject: **optional**

Subject code: **HMH100035BK**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15				
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					
including number of ECTS points for direct teacher-student contact (BK) classes	1.2				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

**I. Relating to knowledge:**

**II. Relating to skills:**

**III. Relating to social competences:**

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1		15
		Total hours: 15

TEACHING TOOLS USED	
N1.	

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	wg kart opracowanych przez SNH	
P =		

PRIMARY AND SECONDARY LITERATURE	
<u>PRIMARY LITERATURE</u>	
<u>SECONDARY LITERATURE</u>	

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT <b>Block of humanistic courses</b> AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY <b>Management and Manufacturing Engineering</b>				
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	K2ZIP_W11, K2ZIP_W13	wg kart opracowanych przez SNH		wg kart opracowanych przez SNH

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **BLOK JĘZYKI OBCE (B2+/C1+)**

Name in English: **Block of Foreign languages**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable):

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

Kind of subject: **optional**

Subject code: **JZL1007009**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)		15			
Number of hours of total student workload (CNPS)		30			
Form of crediting		Crediting with grade			
Group of courses					
Number of ECTS points		1			
including number of ECTS points for practical (P) classes		1			
including number of ECTS points for direct teacher-student contact (BK) classes		0.5			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

**I. Relating to knowledge:**

**II. Relating to skills:**

**III. Relating to social competences:**

PROGRAMME CONTENT

Form of classes – Classes		Number of hours
CI1		15
		Total hours: 15

TEACHING TOOLS USED
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EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Classes)		
Evaluation (F – forming (during semester), P – concluding (at semester end))	Educational effect number	Way of evaluating educational effect achievement
F1	wg kart przygotowanych przez SJO	
P =		

PRIMARY AND SECONDARY LITERATURE
<u>PRIMARY LITERATURE</u>
<u>SECONDARY LITERATURE</u>

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT <b>Block of Foreign languages</b> AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY <b>Management and Manufacturing Engineering</b>				
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_U, PEK_K	K2ZIP_K01, K2ZIP_U12, K2ZIP_U16	wg kart przygotowanych przez SJO		wg kart przygotowanych przez SJO



Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **BLOK JĘZYKI OBCE (A1/A2/B1)**

Name in English: **Block of Foreign languages**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable):

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

Kind of subject: **optional**

Subject code: **JZL100710BK**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)		45			
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					

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

**I. Relating to knowledge:**

**II. Relating to skills:**

**III. Relating to social competences:**

PROGRAMME CONTENT

Form of classes – Classes		Number of hours
CI1		60
		Total hours: 60

TEACHING TOOLS USED	
N1.	

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Classes)		
Evaluation (F – forming (during semester), P – concluding (at semester end))	Educational effect number	Way of evaluating educational effect achievement
F1	wg kart przygotowanych przez SJO	
P =		

PRIMARY AND SECONDARY LITERATURE	
<u>PRIMARY LITERATURE</u>	
<u>SECONDARY LITERATURE</u>	

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT <b>Block of Foreign languages</b> AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY <b>Management and Manufacturing Engineering</b>				
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, PEK_U02	K2ZIP_U12, K2ZIP_U17	wg kart przygotowanych przez SJO		wg kart przygotowanych przez SJO
PEK_K01	K2ZIP_K01	wg kart przygotowanych przez SJO		wg kart przygotowanych przez SJO

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **BLOK ZAJĘCIA SPORTOWE**

Name in English: **Block of Sports Activities**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable):

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

Kind of subject: **optional**

Subject code: **WFW010000BK**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)		15			
Number of hours of total student workload (CNPS)		30			
Form of crediting		Crediting with grade			
Group of courses					
Number of ECTS points		1			
including number of ECTS points for practical (P) classes		1			
including number of ECTS points for direct teacher-student contact (BK) classes					

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

**I. Relating to knowledge:**

**II. Relating to skills:**

**III. Relating to social competences:**

PROGRAMME CONTENT

Form of classes – Classes		Number of hours
CI1		15
		Total hours: 15

TEACHING TOOLS USED	
N1.	

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Classes)		
Evaluation (F – forming (during semester), P – concluding (at semester end))	Educational effect number	Way of evaluating educational effect achievement
F1	wg kart przygotowanych przez SWFiS	
P =		

PRIMARY AND SECONDARY LITERATURE	
<u>PRIMARY LITERATURE</u>	
<u>SECONDARY LITERATURE</u>	

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT <b>Block of Sports Activities</b> AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY <b>Management and Manufacturing Engineering</b>				
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_K01	K2ZIP_K06	wg kart przygotowanych przez SWFiS		wg kart przygotowanych przez SWFiS

Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Zarządzanie strategiczne**

Name in English: **Strategic management**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable):

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

Kind of subject: **obligatory**

Subject code: **ZPM041002**

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)	90				
Form of crediting	Examination				
Group of courses					
Number of ECTS points	3				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	1.8				

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

1. Knowledge of macro- and microeconomics.
2. Basic knowledge of management and marketing industrial establishment.
3. Knowledge of the extent and basic skills in costing for engineers and financial grounds.

### SUBJECT OBJECTIVES

- C1. To acquaint students with the management company from the perspective of top management or owner.
- C2. Presentation of basic problems associated with the activities of development and the bankruptcy of the company.
- C3. Getting to know the essence of the mission, vision and identity of the organization (company).
- C4. Getting to know the appropriate methods and techniques enabling analysis of the state and prospects for development.
- C5. Presentation of the problems of planning and strategic decision making - methods, tools, techniques.

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - He has knowledge about the nature and concept of strategic management, in particular strategic analysis of the company and possible models of corporate strategy.

PEK\_W02 - It has a general knowledge of the parameters and application of standards to identify and analyze the situation of the company.

PEK\_W03 - Understand the relationships and dependencies between the business environment and strategies implemented by the company.

### II. Relating to skills:

### III. Relating to social competences:

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	The genesis and essence of strategic management.	2
Lec2	Business concept. Concepts, functions and role of the mission.	2
Lec3		2
Lec4		2
Lec5	Analysis of the potential of strategic enterprises.	2
Lec6		2
Lec7	Taking into account technology portfolio analysis.	2
Lec8	The strategic goals.	2
Lec9	Strategies for diversification.	2
Lec10	Strategies for market development.	2
Lec11	The strategies of vertical integration.	2
Lec12	Competitive strategies.	2
Lec13	The presentation document production enterprise strategy development engineering industry.	2
Lec14	The identity of the company. Deployment and implementation strategies.	2
Lec15	Schools of strategic management.	2
		Total hours: 30

## TEACHING TOOLS USED

N1. informative lecture

N2. problem lecture

N3.

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	exam
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Romanowska M.: Planowanie strategiczne w przedsiębiorstwie. PWE Warszawa 2009; STRATEGOR. Zarządzanie firmą. Strategie. Struktury. Decyzje. tożsamość PWE warszawa 1995; Steinmann H.G., Schreyogg G.: Zarządzanie - podstawy kierowania przedsiębiorstwem. Koncepcje, funkcje, przykłady. Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2001; Porter M.: Strategia konkurencji - metody analizy sektorów i konkurentów. PWE Warszawa 1999; Moszkowicz M.(red.): Zarządzanie strategiczne - systemowa koncepcja biznesu, PWE Warszawa 2005.

SECONDARY LITERATURE

Oblój K.: Strategia organizacji. PWE Warszawa 1998.; Romanowska M., Gieszewska G.: Analiza strategiczna przedsiębiorstwa. PWE Warszawa 2009; Krupski R.: Zarządzanie strategiczne. Wyd. AE Wrocław 2003; Ansoff H.I.: Zarządzanie strategiczne. Wyd. PWE Warszawa 1985 2003; Moszkowicz M.: Strategia przedsiębiorstwa okresu przemian. PWE, Warszawa 2006.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Strategic management**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_W05, K2ZIP_W06	C1, C2, C3, C4, C5	Lec1-Lec15	N1, N2, N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Modelowanie procesów produkcyjnych**

Name in English: **Modelling of the production processes**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable):

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

Kind of subject: **obligatory**

Subject code: **ZPM041003**

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			60	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	2			2	
including number of ECTS points for practical (P) classes				2	
including number of ECTS points for direct teacher-student contact (BK) classes	1.2			1.4	

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

1. Basic knowledge about the organization (production company) and its management principles.

### SUBJECT OBJECTIVES

- C1. The acquisition of knowledge and skills in the area of modeling of production systems using methods IDEF0 and UML.
- C2. The acquisition of knowledge and skills in the area of modeling of production systems using method BPMN.
- C3. The acquisition of knowledge and skills in the area of modeling of production systems using method VSM.

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - The student has a basic knowledge in the area of modeling of production systems

PEK\_W02 - The student has an extended knowledge in the area of modeling of production systems using methods IDEF0, UML, BPMN and VSM

### II. Relating to skills:

PEK\_U01 - Student is able to independently develop a model of the production system using the IDEF0 method (Integrated Definition for Function Modelling) and UML method (Unified Modelling Language).

PEK\_U02 - Student is able to independently develop a model of the production system using the BPMN method (Business Process Model & Notation)

PEK\_U03 - Student is able to independently develop a model of the production system using the VSM method (Value Stream Mapping).

### III. Relating to social competences:

PEK\_K01 - Student is able to prepare and present the analysis of the results of the project

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Basic concepts. System - Process - Model	2
Lec2	IDEF0 method - part 1 - Description of the method	2
Lec3	IDEF0 method - part 2 - Tutorial	2
Lec4	UML method - part 1 - Use case diagram, Class diagram	2
Lec5	UML method - part 2 - Activity diagram, State Machine diagram, Time diagram	2
Lec6	UML method - part 3 - Tutorial	2
Lec7	BPMN method - part 1 - Description, Activities, Users - Business roles	2
Lec8	BPMN method - part 2 - Events, Gates	2
Lec9	BPMN method - part 3 - Tutorial	2
Lec10	VSM method - part 1 - Current state diagram	2
Lec11	VSM method - part 2 - Future state diagram	2
Lec12	VSM method - part 3 - Tutorial	2
Lec13	Other methods (Flowchart, Aris, Corporate Modeler etc.)	2
Lec14	Case studies	2
Lec15	End test	2
		Total hours: 30
Form of classes – Project		Number of hours
Proj1	- The organization of classes, - Discussion of the course, the presentation of the scoring system designs and conditions for end mark. - Presentation of schedules for each project, and an introduction to the topics	2
Proj2	Projekt 1a. Model of the system using IDEF0 method	6

Proj3	Projekt 1b. Model of the system using UML method	6
Proj4	Projekt 1c. Model of the system using BPMN method	6
Proj5	Projekt 1d. Model of the system using VSM method	6
Proj6	Summary. Presentation of the project results	4
		Total hours: 30

TEACHING TOOLS USED

- N1. self study - preparation for project class
- N2. report preparation
- N3. informative lecture
- N4. problem lecture
- N5. problem discussion

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	End test
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_U01	Points for project
F2	PEK_U01	Points for project
F3	PEK_U02	Points for project
F4	PEK_U03	Points for project
F5	PEK_U01 + PEK_U02 + PEK_U03	Points for attendance
P = F1 + F2 + F3 + F4 + F5		

PRIMARY AND SECONDARY LITERATURE

### PRIMARY LITERATURE

[1] „Integration definition for function modelling (IDEF0)”. Federal Information Processing Standards Publications, 21-grudz-1993.

[2] G. Booch, J. Rumbaugh, i I. Jacobson, UML - przewodnik użytkownika, Wyd. 2. Warszawa: Wydawnictwa Naukowo-Techniczne, 2002.

[3] S. Drejewicz, Zrozumieć BPMN modelowanie procesów biznesowych. Gliwice: Wydawnictwo Helion, 2012.

[4] M. Rother i J. Shook, Naucz się widzieć: Eliminacja marnotrawstwa poprzez mapowanie strumieni wartości, Wyd. 2, popr. Wrocław: Lean Enterprise Institute Polska, 2009.

### SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Modelling of the production processes**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_W02, K2ZIP_W03	C1, C2, C3	Lec1-Lec14	N3 - N5
PEK_U01, PEK_U02, PEK_U03	K2ZIP_U02, K2ZIP_U07, K2ZIP_U09	C1, C2, C3	Pr1-Pr6	N1 - N2
PEK_K01	K2ZIP_K05	C1 + C2 + C3	Pr1-Pr6	N1 - N2

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Symulacja procesów produkcyjnych**

Name in English: **The simulation of manufacturing processes**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable):

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

Kind of subject: **obligatory**

Subject code: **ZPM041006**

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 process planning

### SUBJECT OBJECTIVES

- C1. Introduction to with the problems design methods of simulation models of manufacturing systems
- C2. The acquisition of practical skills-building simulation models and analyzing their results
- C3. Understanding the issues of multi-criteria optimization of manufacturing systems

SUBJECT EDUCATIONAL EFFECTS

**I. Relating to knowledge:**

**II. Relating to skills:**

PEK\_U01 - Using the example simulation tool for manufacturing systems

PEK\_U02 - Using a sample tool to optimize production systems

PEK\_U03 - Building adequate, discrete simulation models for production systems

**III. Relating to social competences:**

PROGRAMME CONTENT

Form of classes – Project		Number of hours
Proj1	Building a deterministic simulation model of manufacturing system in order to determine the optimal frequency of deliveries	4
Proj2	Building a deterministic simulation model of manufacturing system in order to determine the optimal frequency of deliveries including hardening operations	2
Proj3	Building a deterministic simulation model of manufacturing system in order to determine the optimal frequency of delivery including quality control operations	2
Proj4	Budowa symulacyjnego modelu deterministycznego systemu wytwórczego w celu wyznaczenia optymalnej częstotliwości dostaw przy różnorodnym planie produkcji	4
Proj5	Building deterministic simulation model of manufacturing system to determine the optimum frequency of operation of supply assembly including	2
Proj6	Building a deterministic simulation model of manufacturing system in order to determine the optimal frequency of supply, taking into account the various modes of transport and the cost of	2
Proj7	Performing a test	2
Proj8	Building non-deterministic simulation model of manufacturing system	2
Proj9	Building a simulation model of the manufacturing system niedeterministycznego uwzględnieniem breaks and the use of macros	2
Proj10	Building non-deterministic simulation model of manufacturing system using variables and attributes	2
Proj11	Perform non-deterministic multi-criteria optimization of manufacturing systems	4
Proj12	Perform a test	2
		Total hours: 30

TEACHING TOOLS USED

N1. problem exercises

N2. case study

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	Defence project
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Discrete-event system simulation / Jerry Banks [et al.]. Upper Saddle River : Pearson Education cop. 2010.

SECONDARY LITERATURE

System modeling and simulation : an introduction / Frank L. Severance. Chichester : John Wiley & Sons 2001.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**The simulation of manufacturing processes**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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, PEK_U02, PEK_U03	K2ZIP_U02, K2ZIP_U03	C1, C2, C3	Pr1 - Pr12	N1, N2

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Zintegrowane systemy zarządzania**

Name in English: **Integrated management systems**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable):

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

Kind of subject: **obligatory**

Subject code: **ZPM041007**

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 design, characteristics and funkcjons of production systems
2. Knowledge of basic organizational criteria of manufacturing systems

### SUBJECT OBJECTIVES

- C1. The acquisition of skills in the design of information systems, with particular emphasis on the design flow of information and documentation in the manufacturing systems
- C2. Knowledge of design tools for information systems and the problems of implementation and customization of information systems to needs of enterprises
- C3. Understanding the role that information technology and information systems serve in the management of production systems



## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

### II. Relating to skills:

PEK\_U01 - The acquisition of practical skills in the field of analysis and design of integrated information systems for industrial companies

PEK\_U02 - Able to model the flow of work and information in the various functional areas of business, able to integrate data from various functional areas of production companies to achieve production orders

PEK\_U03 - Able to develop documentation related to the production flow

### III. Relating to social competences:

PEK\_K01 - Able to think and critically analyze the operation of the manufacturing system for improve its effectiveness

PEK\_K02 - Able to interact and work in a group, taking the different organizational roles in manufacturing companies and service

PEK\_K03 - Understands the need for continuous improvement of the organization, its processes and products and the need for organizational change

## PROGRAMME CONTENT

Form of classes – Project		Number of hours
Proj1	Choice and an analysis of the selected subsystems of the production company	4
Proj2	Analysis of possibilities of integration of individual subsystems	4
Proj3	Analysis of information needs	4
Proj4	Development of models of workflow and information and in the individual functional areas using selected methods of modeling functions and processes	6
Proj5	Development of models of data and production documentation flow	6
Proj6	Analysis of individual data integration capabilities in the model from different functional areas to achieve an exemplary production orders	6
		Total hours: 30

## TEACHING TOOLS USED

N1. case study

N2. tutorials

N3. self study - preparation for project class

N4. problem discussion

## 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_U1, PEK_U2, PEK_U3	
F2	PEK_K01, PEK_K02, PEK_K03	
P = 0,9*F1+0,1*F2		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

- 1: Kisielnicki J., Sroka H., Systemy informacyjne biznesu, Agencja Wydaw. Placet, Warszawa 2005
- 2: Kisielnicki J.: MIS – Systemy informacyjne zarządzania. Wydawnictwo PLACET, Warszawa 2008
- 3: Barker R., Longman C.: CASE Method. Modelowanie funkcji i procesów, WNT, Warszawa 2001

SECONDARY LITERATURE

- 1: Nowicki A., Sitarska M.: Procesy informacyjne w zarządzaniu. Wrocław, Wyd. Uniwersytetu Ekonomicznego we Wrocławiu, 2010
- 2: Wrycza S. : Analiza i projektowanie systemów informatycznych zarządzania. Metodyki, techniki, narzędzia. PWN Warszawa, 1999

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Integrated management systems**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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, PEK_U02, PEK_U03	K2ZIP_U08, K2ZIP_U09, K2ZIP_U10	C1, C2, C3	Pr1-Pr6	N1, N2, N3, N4
PEK_K01, PEK_K02, PEK_K03	K2ZIP_K04, K2ZIP_K05	C1, C2, C3	Pr1 - Pr6	N1, N2, N3, N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

### SUBJECT CARD

Name in Polish: **Optymalizacja rozmieszczenia stanowisk roboczych**

Name in English: **Optimizing deployment of workstations**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable):

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

Kind of subject: **obligatory**

Subject code: **ZPM041010**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15			15	
Number of hours of total student workload (CNPS)	30			60	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	1			2	
including number of ECTS points for practical (P) classes				2	
including number of ECTS points for direct teacher-student contact (BK) classes	0.6			1.4	

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

1. Basic knowledge of logistics and enterprise management
2. The ability to build simulation models for discrete manufacturing systems

### SUBJECT OBJECTIVES

- C1. Acquisition of knowledge about how to deploy workstations
- C2. Learn how to build a layout plans
- C3. Learn how to optimize the planned deployments of workstations

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - He has knowledge of the mathematical arrangement of workplaces

PEK\_W02 - He has knowledge of the technological conditions of the deployment of workstations

PEK\_W03 - He knows the basic techniques of simulation deployment of workstations

### II. Relating to skills:

PEK\_U01 - He can choose a variety of simulation tools to verify the layout plans

PEK\_U02 - Can apply various simulation tools to verify and optimize the layout plans

PEK\_U03 - The student is able to properly make the deployment plan workstations

### III. Relating to social competences:

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Methodological approaches in the design of the deployment of production cells	3
Lec2	Mathematical methods for designing the deployment of workstations	2
Lec3	Technical considerations taken into account when deploying workstations	4
Lec4	Verification of simulation methods proposed solutions	2
Lec5	Data collection for the project simulation	2
Lec6	Classification of forms of organization of production for manufacturing cells	2
		Total hours: 15
Form of classes – Project		Number of hours
Proj1	Determination of the coefficient $i_0$ to match the number of facilities for the production plan and the available production technology	2
Proj2	The selection of machinery from manufacturers' catalogs. Optimizing deployment of workstations by using a mathematical algorithm MST (Modified Spanning Tree Algorithm)	4
Proj3	Optimizing deployment of workstations by using a mathematical algorithm triangles Schmigalli	2
Proj4	Optimizing deployment of workstations by using a mathematical algorithm ROC (Rank Order Clustering)	2
Proj5	Develop deployment of workstations, taking into account technological conditions. A comparison of the above methods based on the calculated cost.	3
Proj6	Assessment of the project	2
		Total hours: 15

## TEACHING TOOLS USED

- N1. traditional lecture with the use of transparencies and slides
- N2. informative lecture
- N3. problem exercises
- N4. calculation exercises
- N5. case study

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	Test
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_U01, PEK_U02, PEK_U03	Assessment of the project
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. PROJEKTOWANIE ROZMIESZCZENIA STANOWISK ROBOCZYCH / STANISLAW LIS, KRZYSZTOF SANTAREK Warszawa : PWN, 1980.
2. Podstawowa problematyka projektowania stanowisk pracy / Teresa Musioł, Jarosław Grzesiek ; Wyższa Szkoła Ekonomii i Administracji w Bytomiu. Bytom : Wyższa Szkoła Ekonomii i Administracji, 2008.

SECONDARY LITERATURE

PROJEKTOWANIE STANOWISK I PROCESOW PRACY / KAROL RYPULAK. LUBLIN : POLITECHNIKA, 1981.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Optimizing deployment of workstations**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_W02, K2ZIP_W03, K2ZIP_W07	C1	Lec1 - Lec9	N1, N2
PEK_U01, PEK_U02, PEK_U03	K2ZIP_U02, K2ZIP_U03, K2ZIP_U07	C2, C3	Pr1-Pr6	N3, N4, N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Innowacyjne technologie mechaniczne**

Name in English: **Innovative mechanical technologies**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable):

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

Kind of subject: **obligatory**

Subject code: **ZPM041011, ZPM041005**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30		15	15	
Number of hours of total student workload (CNPS)	30		60	30	
Form of crediting	Crediting with grade		Crediting with grade	Crediting with grade	
Group of courses					
Number of ECTS points	1		2	1	
including number of ECTS points for practical (P) classes			2	1	
including number of ECTS points for direct teacher-student contact (BK) classes	0.6		1.4	0.7	

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

1. Student will be acquainted with modern methods of computer aided technologies supporting product development - those were the main subject of the course of Product Development Technologies during earlier studies
2. Issues of concept design, construction in 2D and 3D, especially computer modeling directed at different manufacturing technologies
3. Basic information on technologies of rapid prototyping as a verifying tool in virtual prototyping

### SUBJECT OBJECTIVES

- C1. Methods of manufacturing prototypes and prototype series. Additive Manufacturing Technologies. Rapid Prototyping
- C2. Rapid Prototyping of products made of polymers, metals and ceramics
- C3. Rapid Tooling
- C4. Rapid Manufacturing
- C5. Medical applications of additive manufacturing technologies

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Student should recognize machines for rapid prototyping and characterize their basic usability features

PEK\_W02 - Student should know how to optimally select and propose appropriate rapid prototyping technology based on requirements for new products which are to be verified physically

### II. Relating to skills:

PEK\_U01 - Student should perform a product development process optimized for its physical verification and evaluation for function and quality

PEK\_U02 - Student should be able to propose construction assumptions for a new product and design using proper engineering tools, based on a chosen manufacturing technology

### III. Relating to social competences:

PEK\_K01 - Awareness of the role of a product engineer in the process of production planning and the need for responsibility and engagement in new product development in a company

PEK\_K02 - Awareness of legal and business aspects and effects of engineering activities in the area of new product development

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Types and applications of physical prototypes. Manufacturing methods.	2
Lec2	Technologies of Rapid Prototyping - concept models	2
Lec3	Technologies of Rapid Prototyping - functional models made of polymers	2
Lec4	Technologies of Rapid Prototyping - functional models made of polymers	2
Lec5	Technologies of Rapid Prototyping - functional models made of metals	2
Lec6	Technologies of Rapid Prototyping - functional models made of metals	2
Lec7	Technologies of Rapid Tooling - classification	2
Lec8	Technologies of Rapid Tooling	2
Lec9	Technologies of Rapid Tooling - manufacturing prototype series of metals	2
Lec10		2
Lec11	Technologies of Rapid Manufacturing	2
Lec12	Technologies of Rapid Manufacturing	2
Lec13	Innovative mechanical technologies in medical applications -	2
Lec14	Innovative mechanical technologies in medical applications -	2
Lec15	Final test	2
		Total hours: 30
Form of classes – Laboratory		Number of hours
Lab1	Technologies of Rapid Prototyping - concept models	2
Lab2	Technologies of Rapid Prototyping - functional models made of polymers	3



Lab3	Technologies of Rapid Prototyping - functional models made of metals	2
Lab4	Technologies of Rapid Tooling - manufacturing prototype series of polymers	2
Lab5	Technologies of Rapid Tooling - manufacturing prototype series of metals	2
Lab6	Technologies of Rapid Manufacturing	2
Lab7	Innovative mechanical technologies in medical applications	2
		Total hours: 15
Form of classes – Project		Number of hours
Proj1	Development of design assumptions for example new products	3
Proj2	Analysis and functional evaluation of design concepts for new products	2
Proj3	Design and visualization of 3D concepts of new products	2
Proj4	Design and visualization of 3D constructions of new products	2
Proj5	Analysis and virtual verification of CAD design models of new products	2
Proj6	Manufacturing (example) physical models of prototypes of new products	2
Proj7	Physical verification, functional and quality evaluation of manufactured prototypes of new products	2
		Total hours: 15

#### TEACHING TOOLS USED

- N1. informative lecture
- N2. multimedia presentation
- N3. self study - preparation for laboratory class
- N4. self study - preparation for project class
- N5. project presentation

#### 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	Final 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_W01, PEK_W02	short test
P = F		

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_K01, PEK_K02	Evaluation and defense of a developed project
P = F1		

PRIMARY AND SECONDARY LITERATURE		
<u>PRIMARY LITERATURE</u>		
E. Chlebus, tytuł: Techniki komputerowe CAx w inżynierii produkcji, wydawnictwo: WNT, rok: 2000		
<u>SECONDARY LITERATURE</u>		
E. Chlebus, T. Boratynski, B. Dybała, M. Frankiewicz, P. Kolinka, tytuł: Innowacyjne technologie Rapid Prototyping - Rapid Tooling w rozwoju produktu, wydawnictwo: Oficyna Wydawnicza PWR, rok: 2003		

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT <b>Innovative mechanical technologies</b> AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY <b>Management and Manufacturing Engineering</b>				
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	K2ZIP_W04	C1 - C5	Lec1-Lec15	N1 - N5
PEK_U01, PEK_U02	K2ZIP_U04	C1 - C5	Pr1-Pr7, La1 - La7	N1 - N5

PEK_K01, PEK_K02	K2ZIP_K02	C1 - C5	La1-La7	N1 - N5
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Faculty of Mechanical Engineering

### SUBJECT CARD

Name in Polish: **Zarządzanie wiedzą**

Name in English: **Knowledge management**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable):

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

Kind of subject: **obligatory**

Subject code: **ZPM041012**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15			15	
Number of hours of total student workload (CNPS)	30			30	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	1			1	
including number of ECTS points for practical (P) classes				1	
including number of ECTS points for direct teacher-student contact (BK) classes	0.6			0.7	

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

1. Has an established expertise in the use of and communicate using language engineering
2. It has a basic knowledge of manufacturing systems

#### SUBJECT OBJECTIVES

- C1. Learn the basic methods and techniques of knowledge management
- C2. Knowledge of the practical implementation of the chosen strategies of knowledge management systems to industrial practices
- C3. Understanding the structure and possibilities of selected knowledge management tools

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Should understand the definitions of knowledge management and knowledge management characterize targets. ZW system is able to define the purpose of locating, acquiring, developing, transfer and use of knowledge and its protection. Able to identify the flows of knowledge between employees, organizational structure and environment of the organization.

PEK\_W02 - Can recognize and indicate the need for a solution ZW

PEK\_W03 - He knows the technical capabilities of AI systems and can offer different solutions in the area of their application

### II. Relating to skills:

PEK\_U01 - Able to analyze the technical problem or organizational and functional design in terms of ZW system configuration.

PEK\_U02 - He can build a prototype system based on database tools and neural networks

PEK\_U03 - He can build a prototype system based on expert systems

### III. Relating to social competences:

PEK\_K01 - Understands the need for lifelong learning in the field of activity of an engineer specializing in

"Management and production engineering" and and improving professional competence and social

PEK\_K02 - He can think and critically analyze the functioning of systems built to improve its efficiency

PEK\_K03 - Is aware of the responsibility for their own work and its impact on the functioning of the company

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Knowledge as a key resource companies - Knowledge-based economy - Basic Definitions knowledge Management - Definitions of knowledge management - The objectives of knowledge management - The process of knowledge management	1
Lec2	Locating KM - Locating knowledge - Acquisition of knowledge - Developing knowledge - Transfer of knowledge - The use of knowledge - Protection and preservation of knowledge	1
Lec3	Sharing knowledge and its dissemination. - Formal and informal groups Streams flow of knowledge - Staff - Organizational structure - environment	1

Lec4	Benefits and barriers to knowledge sharing, failures as source of knowledge. - The possibility of acquiring knowledge within the company, - Restrictions on the exchange of knowledge - Examples of the use of the knowledge of the failures in the development of the company	1
Lec5	Innovative Economy Operational Programme -OSi priority -typy project beneficiaries	1
Lec6	Informacga and knowledge, information overload -Data, Information, knowledge, wisdom -Rola Experts in knowledge management	1
Lec7	Implementation of the concept of knowledge management in small and medium-sized enterprises of mechanical engineering: - The role of the board in the process of the implementation of knowledge management - Creation of an organizational culture conducive to the sharing of knowledge	1
Lec8	Knowledge management in the enterprise future generation Y	1
Lec9	Principles of design databases for decision support	1
Lec10	Database design cycle - Multi-station database - Tools and Languages fourth generation	1
Lec11	Scope and examples of the use of ANN to KM -Construction network - Types of networks - Learning Network	1
Lec12	Knowledge base systems -Construction Of a knowledge-based systems - The structure of the system	1
Lec13	knowledge Base - Mechanisms of inference - Interfaces - Software tools for the construction of the SE - Scope and examples of the use of the SE	1
Lec14	Computer simulations in the development of knowledge and decision-making	1
Lec15	Final test	1
		Total hours: 15
Form of classes – Project		Number of hours
Proj1	BD can determine the cost of production, - Tables and relationships modeling manufacturing operations, design SQL queries as questions to the database	3
Proj2	Artificial neural networks (ANN} -System for thermal error compensation machine. - The possibility of the ANN software The selection of neural network architecture, - Learning and testing the network, - Evaluation of the results	3
Proj3	Expert system (knowledge base to build the technological process) - The possibility of the system (GURU), tree of knowledge, generating rules - Selection of inference mechanisms, - Build your own expert system prototype	2

Proj4	Provision of information to create knowledge on examples of assembly processes. - Science communication between team leader, - Conversion of information by members of the team to the needs of the leader - The creation of knowledge by the leader for the enterprise.	2
Proj5	Organize your work from the perspective of knowledge management, - The creation of a favorable position whitefish creativity and learning, - Design your own place of work	1
Proj6	Motivation for sharing knowledge, creativity collective - The creation of MEM-s, as a tool to facilitate the sharing of knowledge - Place the problem to solve - Solving the problem of individual and group - Comparison of the individual and team creativity	4
		Total hours: 15

#### TEACHING TOOLS USED

- N1. traditional lecture with the use of transparencies and slides  
N2. self study - preparation for project class  
N3. project presentation

#### 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	test
P = P		

#### 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	presentation
F2	PEK_K01, PEK_K02, PEK_K03	presentation
P = F		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. Jashapara A., Zarządzanie wiedzą. Zintegrowane podejście, PWE, Warszawa 2006.
2. K. Perechuda, Zarządzanie wiedzą w przedsiębiorstwie, Wydawnictwo Naukowe PWN, Warszawa 2005.
3. G. Probst, S. Raub, K. Romhardt, Zarządzanie wiedzą w organizacji, Oficyna Ekonomiczna, Kraków 2002.
4. Jeffrey D. Ullman, Jennifer Widom "Podstawowy wykład z systemów baz danych, WNT, Warszawa 2000
5. W. M. Grudzewski, I. K. Hejduk, Zarządzanie wiedzą w przedsiębiorstwach, Difin, Warszawa 2004
6. j. Fazlagić Innowacyjne zarządzanie wiedzą, Difin, Warszawa 2014
7. A. Balcerak, J. Woźniak, Szkoleniowe metody symulacyjne, Gdańskie wydawnictwo Psychologiczne, Sopot, 2014.

SECONDARY LITERATURE

6. D. A. Waterman, A Guide to Expert Systems, Addison-Wesley Publishing Company
7. R. Tadeusiewicz, Sieci neuronowe, PWN, Warszawa, 1993

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Knowledge management**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_W05, K2ZIP_W10	C1	Lec1-Lec14	N1
PEK_U01, PEK_U02, PEK_U03	K2ZIP_U05	C2, C3	Pr1-6	N2, N3
PEK_K01, PEK_K02, PEK_K03	K2ZIP_K01, K2ZIP_K04	C2, C3	Pr1-6	N2, N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Zarządzanie personelem**

Name in English: **Human resources management**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable):

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

Kind of subject: **obligatory**

Subject code: **ZPM041013**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15				
Number of hours of total student workload (CNPS)	30				
Form of crediting	Crediting with grade				
Group of courses					
Number of ECTS points	1				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	0.6				

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

1. It has a basic knowledge of management and marketing
2. He can interpret profit and loss account Company
3. It has a basic knowledge of communication

### SUBJECT OBJECTIVES

- C1. The course aims to familiarize students with the theoretical and practical approach to the problems of personnel management in organizations
- C2. Familiarize students with the process of negotiating its phases, tactics and strategies
- C3. To acquaint the student with sources of resistance within the organization and methods of overcoming them and methods of motivating people to work

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Formulate goals HR strategy

PEK\_W02 - Distinguish methods and strategies for motivating employees negotiation tactics

PEK\_W03 - Define the sources of resistance within the organization

### II. Relating to skills:

### III. Relating to social competences:

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	The roles and functions of managers. Planning and recruitment of the organization	2
Lec2	Issues related to human resources development: improvement, evaluation, promotion and selection	2
Lec3	Attracting employees to the organization. Methods and staff selection process. Selection and introduction to work	2
Lec4	The methods to motivate people to work. Changes and innovations in the organization	2
Lec5	Crisis and conflict within the organization - methods of stimulating and conflict resolution	2
Lec6	Negotiations - its phases, tactics and strategies	2
Lec7	The talks business, meetings and business meetings. Leadership and leadership. The essence of leadership	2
Lec8	Verbal and non-verbal communication. The art of presentation	1
		Total hours: 15

## TEACHING TOOLS USED

N1. multimedia presentation

N2. case study

N3. self study - self studies and 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	colloquium
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1.Sajkiewicz A., Zasoby ludzkie w firmie, Poltext, Warszawa 2004.2.Jamka B.; Dobór pracowników: Zasoby ludzkie w firmie. Warszawa, Poltext. 1999r.3.Janowska Z.; Zarządzanie zasobami ludzkimi. PWE 2002r.4.Kostera M.; Zarządzanie personelem. Warszawa, PWE, 1999r.5.Lachowicz Z.; Trening potencjału kierowniczego. AE. Wrocław 1995.6.Pocztowski A.; Zarządzanie zasobami ludzkimi. Zakład Narodowy im. Ossolińskich, 1995r.7.Waszkiewicz J.; Jak Polak z Polakiem? Szkice o kulturze negocjowania, PWN 1997r.8. Robertson A., Abbey G., Zarządzanie talentami. Wykorzystuj możliwości najzdolniejszych pracowników. Warszawa 2010.

SECONDARY LITERATURE

1.Pease Allan.; Mowa ciała. Jak odczytywać myśli innych ludzi z ich gestów. Jedność Kielce 2003r.2.Wiszniewski A.; Sztuka mówienia, Videograf II sp. z o.o., Katowice 2003r.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Human resources management**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_W12	C1, C2, C3	lec1 - lec8	N1, N2, N3

SUBJECT SUPERVISOR

dr inż. Zygmunt Domagała tel.: 71 320-27-85 email: Zygmunt.Domagala@pwr.edu.pl

Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Fizykochemia zaawansowanych materiałów funkcjonalnych**

Name in English: **Physicochemistry of advanced functional materials**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Production Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041014**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15				15
Number of hours of total student workload (CNPS)	30				30
Form of crediting	Crediting with grade				Crediting with grade
Group of courses					
Number of ECTS points	1				1
including number of ECTS points for practical (P) classes					1
including number of ECTS points for direct teacher-student contact (BK) classes					

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

1. chemistry and physics on the first university level

### SUBJECT OBJECTIVES

C1. Introduction with relationship of materials structure, properties and method of syntheses.

C2. Introduction with basic knowledge of nanotechnology and nanomaterials

C3. Providing opportunities for students to combine their knowledge of chemistry, ecology, physics, material science

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - The student should have basic knowledge associated with functional ceramic, metallic, polymer and composites materials

PEK\_W02 - The student should have basic knowledge associated with possible applications of functional materials.

PEK\_W03 - The student should have basic knowledge associated with nanomaterials and their functionalization. Student knows prospective applications of nanomaterials.

### II. Relating to skills:

PEK\_U01 - The student should have a competence of using modern achievements of science in engineer practice especially in material selection for optoelectronics, biotechnology, construction, automotive industry, medical sciences

PEK\_U02 - The student should know basic nanotechnology and functional materials terms. The student can assess relationship between the type of material, its structure and properties.

PEK\_U03 - The student can characterize benefits of functional materials applications to world, economy, environment and society.

### III. Relating to social competences:

PEK\_K01 - Student can think and act in imaginative way. Student can search for information and analyse them

PEK\_K02 - Student obeys academic rules.

PEK\_K03 - Student can relate effects of industry with the environmental impact.

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction with the functional materials.	2
Lec2	Nanotechnology and nanomaterials.	3
Lec3	Functional polymer materials.	2
Lec4	Functional metallic materials	2
Lec5	Functional ceramic materials	2
Lec6	Functional composite materials	2
Lec7	Qualifying class –test	2
		Total hours: 15
Form of classes – Seminar		Number of hours
Sem1	Structure and properties of engineering materials	2
Sem2	Structure and properties of nanomaterials	2
Sem3	Functional polymer materials.	3
Sem4	Functional metallic materials.	3
Sem5	Functional ceramic materials.	3
Sem6	Functional composite materials.	2
		Total hours: 15

## TEACHING TOOLS USED

- N1. traditional lecture with the use of transparencies and slides
- N2. multimedia presentation
- N3. tutorials
- N4. problem discussion

## 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 PEK_K01 - PEK_K03	test
P = F1		

## EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Seminar)

Evaluation (F – forming (during semester), P – concluding (at semester end))	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01 - PEK_U03 PEK_K01 - PEK_K03	oral answers, discussions, activity
F2	PEK_U01 - PEK_U03 PEK_K01 - PEK_K03	presentation of demanded problem, an essay on selected problem
P = F1		

## PRIMARY AND SECONDARY LITERATURE

### PRIMARY LITERATURE

Functional and smart materials [Dokument elektroniczny] : structural evolution and structure analysis / Z. L. Wang and Z. C. Kang.

Nanoengineering of structural, functional, and smart materials / ed. by Mark J. Schulz, Ajit D. Kelkar, and Mannur J. Sundaresan.

### SECONDARY LITERATURE

web pages, lectures notes

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Physicochemistry of advanced functional materials**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_W08, K2ZIP_W09, K2ZIP_W11	C1, C2, C3	Lec1-Lec6	N1, N2, N3, N4,
PEK_U01 , PEK_U02, PEK_U03	K2ZIP_U15	C1, C2, C3	Sem1-Sem6	N1, N2, N3, N4,
PEK_K01, PEK_K02, PEK_K03	K2ZIP_K03	C1, C2, C3	Lec1-Lec6, Sem1-Sem6	N1, N2, N3, N4,

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Logistyka zaopatrzenia**

Name in English: **Logistics of supply**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Practical Logistics**

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

Kind of subject: **obligatory**

Subject code: **ZPM041101**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15			15	
Number of hours of total student workload (CNPS)	30			30	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	1			1	
including number of ECTS points for practical (P) classes				1	
including number of ECTS points for direct teacher-student contact (BK) classes	0.6			0.7	

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

1. has a basic knowledge in the areas of management, logistic processes/systems performance design and testing
2. has a basic knowledge in the field of operations research
3. has a basic knowledge in the field of spreadsheet using, e.g. Excel

### SUBJECT OBJECTIVES

- C1. The acquisition of knowledge in the area of supply systems performance.
- C2. Acquiring the ability to define the main problems and tasks that occur in the area of supply logistics.
- C3. Acquiring the ability to define the processes of cooperation and integration in the supply area.



## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - It has an extended knowledge of the research, design, and logistic systems management, especially in the phase of supply performance

PEK\_W02 - Can identify the processes of cooperation and integration in the supply chain's downstream (relations in: supply system - system of production) to reference the desired economic results of the enterprise

### II. Relating to skills:

PEK\_U01 - Can obtain information from literature, databases and other sources

PEK\_U02 - Able to integrate the information, make their interpretation and critical evaluation, and to draw conclusions and formulate and fully justify opinions

PEK\_U03 - Able to prepare a research study

### III. Relating to social competences:

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Logistics of supply - the main definitions, issues, goals and tasks.	2
Lec2	Organization of procurement processes.	2
Lec3	Cooperation with the supplier and the process of supplier evaluation and selection.	2
Lec4	Strategies in the area of supply in the enterprise.	2
Lec5	Transportation and supply delivery performance.	2
Lec6	Information flows in the area of supply.	2
Lec7	Assessment of the level of supply system performance. Minimizing risk in the area of supply.	3
		Total hours: 15
Form of classes – Project		Number of hours
Proj1	Introduction to the course. Simulation of the supply processes organization performance.	2
Proj2	The consolidation / deconsolidation of purchases (own study/case study).	2
Proj3	Problem of supplier analysis and selection process (own study/case study).	2
Proj4	Decision problem "make or buy" (own study/case study)	2
Proj5	Supply inventory management in an enterprise (own study/case study).	2
Proj6	Risk in the area of supply performance (own study/case study)	2
Proj7	Supply system effectiveness (own task/case study). Completion of the course.	3
		Total hours: 15

### TEACHING TOOLS USED

- N1. multimedia presentation
- N2. problem discussion
- N3. tutorials
- N4. self study - preparation for project class
- N5. self study - self studies and 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	A positive evaluation of the written test
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_U01, PEK_U02, PEK_U03,	a positive evaluation of the tasks performed during the project classes
F2	PEK_W01, PEK_W02, PEK_U02,	A positive evaluation of the written test
P = (1/2)F1+(1/2)F2		

### PRIMARY AND SECONDARY LITERATURE

## PRIMARY LITERATURE

1. Bozarth C., Handfield R.B., „Wprowadzenie do zarządzania operacjami i łańcuchem dostaw”, Wyd. Helion S.A., Gliwice, 2007
2. Brzeziński M., „Logistyka w przedsiębiorstwie”, Wyd. Bellona, Warszawa, 2006
3. Chaberek M., „Rachunek decyzyjny w logistyce zaopatrzenia”, Wyd. GWSH, Gdańsk, 2002
4. Kowalska K., „Logistyka Zaopatrzenia”, Wydawnictwo Akademii Ekonomicznej, Katowice, 2005
5. Krawczyk S., „Zarządzanie procesami logistycznymi”, Wyd. PWE, Warszawa, 2001
6. Sarjusz - Wolski Z., „Strategia Zarządzania Zaopatrzeniem”, Wyd. PLACET, Warszawa, 1998
7. Twaróg J., „Mierniki i Wskaźniki Logistyczne”, Wyd. Instytut Logistyki i Magazynowania, Poznań, 2003
8. Vollmuth H.J., „Controlling. Instrumenty od A do Z”, Wyd. Placet, Warszawa, 1995
9. Witkowski J., „Zarządzanie Łańcuchem Dostaw”, Wyd. PWE, Warszawa, 2010
10. Wojciechowski T., „Zarządzanie sprzedażą i zakupem materiałów”, Wyd. PWE, Warszawa, 1999
11. Lyons, Kenneth. "Zakupy zaopatrzeniowe", PWE, Warszawa 2004.

## SECONDARY LITERATURE

1. Blanchard B. S.: Logistics Engineering and Management (5th Ed). Upper Saddle River: Pearson Prentice Hall, 2004
2. Dąbrowska - Mitek M., „Ocena dostawców w przedsiębiorstwach handlowych”, - Problemy Jakości, Luty 2007
3. Mańkowski C., „Kontroling i logistyka zaopatrzenia jako czynniki synergiczne gospodarowania”, Wyd. UW, Gdańsk, 2005
4. Pfohl H.Ch., „Systemy Logistyczne”, Wyd. Instytut Logistyki i Magazynowania, Poznań, 2001
5. Pfohl H.Ch., „Zarządzanie logistyką”, Wyd. Instytut Logistyki i Magazynowania, Poznań, 1998
6. Wolniak R., Skotnicka - Zasadzień B., „Wybrane metody badania satysfakcji klienta i oceny dostawców w organizacjach”, Wydawnictwo Politechniki Śląskiej, Gliwice, 2008

Czasopisma:

1. The International Journal of Logistics Management
2. International Journal of Physical Distribution & Logistics Management
3. Journal of Business Logistics
4. Gospodarka Materiałowa i Logistyka
5. Logistyka

**MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
Logistics of supply  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
Management and Manufacturing Engineering**

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	K2ZIP_LS_W01	C1	Lec1, Lec2, Lec3, Lec4, Lec5, Lec6, Lec7	N1, N2, N5
PEK_U01, PEK_U02, PEK_U03	K2ZIP_LS_U02	C1, C2, C3	Pr1, Pr2, Pr3, Pr4, Pr5, Pr6, Pr7	N1, N2, N3, N4

SUBJECT SUPERVISOR



Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Matematyka stosowana w logistyce**

Name in English: **Applied mathematics in logistics**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Practical Logistics**

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

Kind of subject: **obligatory**

Subject code: **ZPM041102**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30			15	
Number of hours of total student workload (CNPS)	30			60	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	1			2	
including number of ECTS points for practical (P) classes				2	
including number of ECTS points for direct teacher-student contact (BK) classes	0.6			1.4	

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

1. Knowledge of the issues presented in the context of courses "Mathematical Analysis", "Algebra and Analytic Geometry" and "Engineering Statistics".

### SUBJECT OBJECTIVES

C1. Gaining basic knowledge of linear programming and game theory takes into account the aspects of the application.

C2. Gaining ability to formulate optimization problems in decision-making in the field of transport services market, the location means of distribution, organization and management, and optimization of design, technology and systems. Acquiring the ability to formulate issues of optimization problems in game theory.

C3. The acquisition and consolidation of social competencies including emotional intelligence skills involving the cooperation in the group of students aiming to effectively solve problems, taking into account the responsibility, honesty and fairness in the proceedings.

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - As a result of the course the student is able to formulate issues in the field of linear programming methods and decision support. He can define the basic issues of transport tasks and knows the algorithms to solve them. He can define the game matrix and knows the algorithms to solve them.

### II. Relating to skills:

PEK\_U01 - As a result of the course the student is able to calculate issues in the field of linear programming methods and decision support. Able to interpret the results and analyze them. Able to solve tasks in the field of transport tasks and is able to use known algorithms. Can solve tasks of matrix games, can apply the learned algorithms, and is able to analyze the results.

### III. Relating to social competences:

PEK\_K01 - As part of the course, the student gains competence in the public presentation of the effects of selection alternatywnych logistics solutions to the issues under consideration. It should also increase the sense of responsibility for their decisions.

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Operational research as a tool for decision-making processes - classification decision-making processes. Methods of decision making under conditions of uncertainty. Linear Programming (PL) - linear model of decision-making, decisions acceptable and optimal. Methods of solving GB. Graphic solving PL. Solving the material discussed.	2
Lec2	Linear programming models. Formulating and solving EN - interpretation of the results. Simplex algorithm. Solving the material discussed.	2
Lec3	Dualism in linear programming. Matrix calculus in solving PL. The dual problem, dual pricing and their interpretation. Analysis postoptymalizacyjna (sensitivity solutions). Change the parameters of the objective function and the words available in the restrictions. Add or remove decision variables. Comprehensive analysis of the optimal solution.	2
Lec4	Integer linear programming (discrete). Method planes shut off.	2
Lec5	Classic transport tasks - algorithms. Transportation tasks with the criterion of time. Transportation tasks (unbalanced, with limited bandwidth routes). The problem of manufacturing location.	2
Lec6	Examples of issues capable of being reduced to the transportation problem (the problem of optimal allocation). The tasks of transport and production and transport and storage. Minimizing empty runs. Blocking routes. The multi-phase transport task.	2
Lec7	Introduction to graph theory. Project management (network programming). The maximum flow in the network. Ford-Fulkerson algorithm. Decision trees. Minimum spanning tree. The shortest route in the graph - algorithms.	2
Lec8	Depending on the network - deterministic (CPM, PERT) and stochastic (GERT). Analysis of time-cost. Create Gantt charts. Optimisation of resources based networks. Travelling Salesman Problem. Little's algorithm. Problem loading (knapsack). The problem of production and inventory control.	2

Lec9	Optimizing Multi-criteria and selected non-linear decision models solvable methods EN.	2
Lec10	Introduction and examples of games (dormitories, double zero-sum, multi-stage, random). Basic concepts (pure strategy, mixed, optimal payment, the value of the game).	2
Lec11	Matrix Games - mixed strategies, the expected value criterion, graphical method for solving Game $2 \times n$ . John von Neumann theorem on the existence of solutions for each game matrix. Solving the material discussed.	2
Lec12	Examples of the use of mixed strategies: fishing in Jamaica, the game "guerrillas and the police". Tree - a character-developed games. Solving games method "pruning trees" (backward induction).	2
Lec13	Games against nature. Criteria Laplace, Bayesian Hurwicz and Savage, finding the optimal decision.	2
Lec14	Games double zero sum: Nash equilibrium and solutions niekooperacyjne, Pareto optimality, strategies for safe and kontrbezpieczne. Nash arbitration scheme and cooperative solutions. Employer-employee negotiations.	2
Lec15	Final test	2
		Total hours: 30
Form of classes – Project		Number of hours
Proj1	Operational research as a tool for decision-making processes - classification decision-making processes. Methods of decision making under conditions of uncertainty. Linear Programming (PL) - linear model of decision-making, decisions acceptable and optimal. Methods of solving GB. Graphic solving PL. Linear programming models. Formulating and solving EN - interpretation of the results. Simplex algorithm. Solving the material discussed.	2
Proj2	Dualism in linear programming. Matrix calculus in solving PL. The dual problem, dual pricing and their interpretation. Analysis postoptymalizacyjna (sensitivity solutions). Change the parameters of the objective function and the words available in the restrictions. Add or remove decision variables. Comprehensive analysis of the optimal solution. Integer linear programming (discrete). Method planes shut off.	2
Proj3	Classic transport tasks - algorithms. Transportation tasks with the criterion of time. Transportation tasks (unbalanced, with limited bandwidth routes). The problem of manufacturing location. Examples of issues capable of being reduced to the transportation problem (the problem of optimal allocation). The tasks of transport and production and transport and storage. Minimizing empty runs. Blocking routes. The multi-phase transport task.	2
Proj4	Introduction to graph theory. Project management (network programming). The maximum flow in the network. Ford-Fulkerson algorithm. Decision trees. Minimum spanning tree. The shortest route in the graph - algorithms. Depending on the network - deterministic (CPM, PERT) and stochastic (GERT). Analysis of time-cost. Create Gantt charts. Optimisation of resources based networks. Travelling Salesman Problem. Little's algorithm. Problem loading (knapsack). The problem of production and inventory control.	2
Proj5	Optimizing Multi-criteria and selected non-linear decision models solvable methods EN. Introduction and examples of games (dormitories, double zero-sum, multi-stage, random). Basic concepts (pure strategy, mixed, optimal payment, the value of the game).	2

Proj6	Matrix Games - mixed strategies, the expected value criterion, graphical method for solving Game $2 \times n$ . John von Neumann theorem on the existence of solutions for each game matrix. Solving the material discussed. Examples of the use of mixed strategies: fishing in Jamaica, the game "guerrillas and the police". Tree - a character-developed games. Solving games method "pruning trees" (backward induction).	2
Proj7	Games against nature. Criteria Laplace, Bayesian Hurwicz and Savage, finding the optimal decision. Games double zero sum: Nash equilibrium and solutions niekooperacyjne, Pareto optimality, strategies for safe and kontrbezpieczne. Nash arbitration scheme and cooperative solutions. Employer-employee negotiations.	1
Proj8	Final test.	2
		Total hours: 15

#### TEACHING TOOLS USED

- N1. traditional lecture with the use of transparencies and slides
- N2. problem exercises
- N3. calculation exercises

#### 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_K01	test, oral answer
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_U01, PEK_K01	test, oral answer
P = F1		

#### PRIMARY AND SECONDARY LITERATURE



### PRIMARY LITERATURE

[1] Ignasiak E. (red.): Badania operacyjne. Warszawa 2001, PWE[2] Kukuła K. (red.): Badania operacyjne w przykładach i zadaniach. Warszawa 2002, PWN[3] Trzaskalik T.: Wprowadzenie do badań operacyjnych z komputerem. Warszawa 2008, PWE[4] Straffin P.: Teoria gier, 2001, Scholar[5] Malawski M., Wieczorek A., Sosnowska H. (2004): Konkurencjai kooperacja. Teoria gier w ekonomii i naukach społecznych, 2004, PWN.

### SECONDARY LITERATURE

[1] Stadnicki J.: Teoria i praktyka rozwiązywania zadań optymalizacji z przykładami zastosowań technicznych. Warszawa 2006, WNT[2] Szapiro T. (red.): Decyzje menadżerskie z Excelem. Warszawa 2000, PWE[3] Guzik B.: Ekonometria i badania operacyjne. Wydawnictwo AE Poznań, Poznań 1999[4] Krawczyk S.: Badania operacyjne dla menadżerów. Wydawnictwo AE Wrocław 1996[5] Lipiec-Zajchowska M. (red.): Wspomaganie procesów decyzyjnych. Tom III. Badania operacyjne. Wydawnictwo C.H. Beck, Warszawa 2003[6] Anholcer M., Gaspras H., Owczarkowski A.: Przykłady i zadania z badań operacyjnych i ekonometrii. Wydawnictwo AE Poznań, Poznań 2003[7]. Watson J.: Strategia: Wprowadzenie do teorii gier, 2005, Norton, New York.[8] Gibbons R.: Game Theory for Applied Economists, 1992 Princeton U.P.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Applied mathematics in logistics**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_W01, K2ZIP_W03, K2ZIP_W04	C1-C3	Wy1-Wy15,	N1-N3
PEK_U01	K2ZIP_U03, K2ZIP_U05	C1-C3	Pr1-Pr8	N1-N3
PEK_K01	K2ZIP_K01, K2ZIP_K02	C1-C3	Wy1-Wy15, Pr1-Pr8	N1-N3

SUBJECT SUPERVISOR

dr inż. Artur Kierzkowski tel.: 71 320-20-04 email: artur.kierzkowski@pwr.edu.pl

Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Modelowanie procesów logistycznych**

Name in English: **Logistics processes modelling**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Practical Logistics**

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

Kind of subject: **obligatory**

Subject code: **ZPM041103**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30			15	
Number of hours of total student workload (CNPS)	30			60	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	1			2	
including number of ECTS points for practical (P) classes				2	
including number of ECTS points for direct teacher-student contact (BK) classes	1.2			1.4	

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

1. Basic knowledge of management, designing and testing logistics processes and systems
2. Knowledge of spreadsheet, e.g.Excel

### SUBJECT OBJECTIVES

- C1. Developing the knowledge of the areas of logistics systems modeling methodology
- C2. Mastering the skills of planning and designing of logistics systems with special emphasis on tools to support the work of logistics

SUBJECT EDUCATIONAL EFFECTS

**I. Relating to knowledge:**

PEK\_W01 - Student has an extended knowledge of modeling random logistics processes

**II. Relating to skills:**

PEK\_U01 - Student can develop a model of logistic processes using methods of system analysis and computer tools

**III. Relating to social competences:**

PEK\_K01 - Student knows how to interact and work in a group

PEK\_K02 - The student is able to prioritize appropriately for specific tasks and problems

PEK\_K03 - Student can think and act in a creative way

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction to modeling. Objectives, possibilities and limitations of modeling. The stages of construction and testing of models.	2
Lec2	Graphical representation methods of logistics processes.	2
Lec3	Critical path with limited resources, the analysis of parallel activities MAC.	2
Lec4	Dynamic programming.	2
Lec5	Dynamic programming in logistic processes modelling - examples	2
Lec6	Decision making under risk: decision tree and playing with nature.	2
Lec7	Introduction to simulation modeling. Generating pseudo-random numbers.	2
Lec8	Designing and development of the algorithm and simulation program.	2
Lec9	Examples of simulation models for simulating the dynamics of transport - storage processes.	2
Lec10	Collection and analysis of input data for modeling.	2
Lec11	The verification and evaluation of the results of simulations. The model testing.	2
Lec12	Introduction to queuing theory: the process of birth and death.	2
Lec13	Discussion of examples of queuing theory: systems of M/M/m type without queue.	2
Lec14	Discussion of examples of queuing theory: systems of M/M/m type with queue.	2
Lec15	Final test.	2
		Total hours: 30
Form of classes – Project		Number of hours
Proj1	Discussion of laboratory plan, requirements, terms and conditions of the course completion. Presentation of selected case studies based on newspaper articles.	2
Proj2	The choice of the number of transport-storage equipment - based on a graphical model of the process.	2
Proj3	The problem of storage location in a given distribution network.	2

Proj4	Selecting the option of process of purchase and storage - using dynamic programming methods.	2
Proj5	Construction of the decision tree for a given example.	2
Proj6	The simulation of the (S, Q) inventory control model in random conditions.	2
Proj7	Testing of the simulated inventory control model and searching of its optimal parameters.	3
		Total hours: 15

TEACHING TOOLS USED	
<p>N1. multimedia presentation  N2. problem discussion  N3. tutorials  N4. self study - preparation for project class  N5. self-study and preparation for the test completion</p>	

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	evaluation of the written test
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_U01, PEK_K01, PEK_K02, PEK_K03	evaluation of the tasks carried out in the classroom project
F2	PEK_U01	evaluation of the written test
P = (1/2)F1+(1/2)F2		

PRIMARY AND SECONDARY LITERATURE	
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#### PRIMARY LITERATURE

1. Bozarth C., Handfield R.B., Wprowadzenie do zarządzania operacjami i łańcuchem dostaw., Helion, 2007
2. Ciesielski M.(red.), Instrumenty zarządzania łańcuchami dostaw, PWE,2009
3. Chaberek M, Modelowanie procesów i systemów logistycznych.Cz. 1., Wyd. U.G. Gdansk, 2001
4. Krawczyk S., Metody ilościowe w logistyce (przedsiębiorstwa) t.II, Wydawnictwo C. H. Beck, 2001
5. Pfohl H-Ch., Systemy logistyczne: podstawy organizacji i zarządzania,Wyd. IliM, Poznan , 2001

#### SECONDARY LITERATURE

1. Blanchard B. S., Logistics Engineering and Management (5th Ed). Upper Saddle River: Pearson Prentice Hall, 2004
2. Grajewski P., Organizacja procesowa, PWE, 2007
3. Mokrzyński H., Logistyka: podstawy procesów logistycznych, WIG, Białystok, 1998
4. Wojciechowski A., Systemy logistyczne, WAT, 2007

**MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
Logistics processes modelling  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
Management and Manufacturing Engineering**

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	K2ZIP_LS_W08	C1	Le.1, Le.2, Le.3, Le.4, Le.5, Le.6, Le.7, Le.8, Le.9, Le.10, Le.11, Le.12, Le.13, Le.14, Le.15	N1, N2, N5
PEK_U01	K2ZIP_LS_U10	C1, C2	Pr1, Pr2, Pr3, Pr4, Pr5, Pr 6, Pr7	N1, N2, N3, N4
PEK_K01, PEK_K02, PEK_K03	K2ZIP_LS_K01, K2ZIP_LS_K02, K2ZIP_LS_K03	C2	Pr1, Pr2, Pr3, Pr4, Pr5, Pr 6, Pr7	N4

**SUBJECT SUPERVISOR**

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Faculty of Mechanical Engineering

### SUBJECT CARD

Name in Polish: **Projektowanie systemów transportowo-magazynowych**

Name in English: **Systems design of transportation and warehousing**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Practical Logistics**

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

Kind of subject: **obligatory**

Subject code: **ZPM041104**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30			15	
Number of hours of total student workload (CNPS)	30			30	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	1			1	
including number of ECTS points for practical (P) classes				1	
including number of ECTS points for direct teacher-student contact (BK) classes	0.6			0.7	

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

1. has a basic knowledge of management and design processes and logistics systems
2. Has knowledge in the field of logistics

#### SUBJECT OBJECTIVES

- C1. Understanding the issues concerning planownaia and projektownaia transport and storage systems.
- C2. Acquiring the ability to plan and organize material and information flows in warehouses.
- C3. Acquiring the ability to optimize logistics systems.

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Able to define the concept of transport system - storage, explain its construction, calling its individual components.

PEK\_W02 - Can describe for selected cases to propose their own solutions for transport and storage, discussing their choices, to indicate the most appropriate having regard to the strategy.

PEK\_W03 - Able to calculate the sample solution and transport system magazynowego at the operational level.

### II. Relating to skills:

PEK\_U01 - He can decide and choose the elements of the design process and transport and storage.

PEK\_U02 - Has the ability to develop a system of documentation for transportation and storage.

PEK\_U03 - Has the ability to estimate the cost of transport and storage system and exploit them.

### III. Relating to social competences:

PEK\_K01 - Works independently and interact as a team

PEK\_K02 - Respects the findings doing the job.

PEK\_K03 - Discussed, maintaining openness to other sentence.

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introductory lecture: - The content of the lecture. - Assessment and timing tests. - Basic and further reading. - Organization of the course.	1
Lec2	Identification of logistic processes in conveying and storage. -definition Warehouse. Identify the basic processes of transport and storage. Identify the functional-process storage areas. -definition Unit load. -Fronty Handling. -Work Cargo.	2
Lec3	Methods of presentation of flow record cargo logistics storage system. -Scenografia Organizatorska. -Synoptyczne Charts. -Wykresy Sankey. -Credit Material flow process.	2
Lec4	The allocation of the objects in the planning of cargo flows. Metoda Schimigalli. komputer Metody  Trucking - optimization of cargo flows Problem transport route planning. Podstawowe structural solutions. Przykłady computing	2

Lec5	Designing storage structure. Magazyny: high and low storage. Magazyn the "regime" temperature. Magazyn cross-dock. Magazyn bulk materials. Magazyn liquid materials.	2
Lec6	Colloquium 1z 2. The test covers material from classes 1-5	1
Lec7	Selection of equipment for storage. Składowanie static without racking (short repetition). Składowanie static. Składowanie dynamic.	2
Lec8	Forklift trucks. Charakterystyka universal forklift. Charakterystyka specialized forklifts.	2
Lec9	Rack Charakterystyka stacking machines. Harmonogramowanie time stacker cranes. Optymalizacja stacker cranes work.	2
Lec10	Scheduling time of mobile devices in the transport logistics warehouse systems Harmonogramowanie time forklifts. Harmonogramowanie time stacker cranes.	2
Lec11	Conveyors in logistics warehouse systems. Rodzaje conveyors. Rozwiązania construction. Zasady selection of conveyors	2
Lec12	The selection means of the flow of information. Oznaczanie pallets in the warehouse. Oznaczanie loading units in stock. Wybór of information technology in logistics storage system. Dobór reading devices 1D, 2D and RFID. (stationary scanners, radio with docking station, camera) Dobór printing devices / programming: 1D, 2D and RFID.	2
Lec13	The choice of computer-aided systems work logistic storage system Systemy WMS, MRP, ERP. Szczegółowe WMS system performance. Bazy logistic data storage systems	2
Lec14	Logistics optimization methods of storage systems. Energy consumption of storage systems Metody expert. Sposoby assess and reduce the energy consumption of selected processes magazynowych	2
Lec15	Colloquium 2z2. colloquium overall	1
Lec16	Educational trip to the store or office dealing with the structural design magazines.	2
Lec17	Discussion of the trip. Exposure to credit ratings lecture.	1
		Total hours: 30
Form of classes – Project		Number of hours



Proj1	Discussion of the organization of classes and examination of project activities. Providing basic and supplementary literature. Development of unit load forming algorithm EURO subjects piece of various dimensions, weight, size and resistance to physical exposure.	2
Proj2	Project deposition distribution of palletised goods in the warehouse, taking into account the classification: areas, zones and places.	2
Proj3	Scheduling transport cycles of selection and evaluation of technical means used in the design magazine - for example a forklift.	2
Proj4	Scheduling transport cycles of selection and evaluation of technical means used in the design magazine - for example rack stacker crane.	2
Proj5	Project completion storage subsystem piece units on the main line and picking bays.	2
Proj6	Analysis and identification of logistics for the storage system adopted in the project storage solutions for process automation.	2
Proj7	Choice concept store, technologies and processes - with diversity dimensions of goods and the size of the line of orders (from single pieces to full pallets on the same SKU).	2
Proj8	Overview of completed projects, a summary of the project activities. Credits.	1
		Total hours: 15

TEACHING TOOLS USED

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

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	test
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_U01, PEK_U02, PEK_U03	evaluation of the computational part of the project
F2	PEK_K01, PEK_K02, PEK_K03	participation in discussions of problem, the report - in the form of presentation of the group their projektów, defense project
P = (F1+F2)/2		

### PRIMARY AND SECONDARY LITERATURE

#### PRIMARY LITERATURE

- 1.Korzeń Z.: „Logistyczne systemy transportu bliskiego i magazynowania” T. I; Instytut Logistyki i Magazynowania, Poznań, 1998.
- 2.Korzeń Z.: „Logistyczne systemy transportu bliskiego i magazynowania” T. II, Instytut Logistyki i Magazynowania, Poznań, 1999.
- 3.Krawczyk S. (red.): „Logistyka. Teoria i Praktyka”, T.1, DIFIN, Warszawa, 2012.
- 4.Krawczyk S. (red.): „Logistyka. Teoria i Praktyka”, T.2, DIFIN, Warszawa, 2012.
- 5.Zajac P.: „Systemy magazynowe”, Oficyna Wydawnicza NDiO, Wrocław, 2010.
- 6.Fijałkowski J.: „Transport wewnętrzny w systemach logistycznych”; Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2001.

Czasopisma specjalistyczne:

- 1.Logistyka
- 2.Nowoczesny Magazyn
- 3.Eurologistics

#### SECONDARY LITERATURE

- [1]. Gudehus T.: „Logistik” T. I; Grundlagen, Verfahren und Strategien; Springer, Hamburg; 1999;
- [2]. Gudehus T.: „Logistik” T. I; Netzwerke, Systeme und Lieferketten; Springer, Hamburg; 1999;

### MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT **Systems design of transportation and warehousing** AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Management and Manufacturing Engineering**

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,	K2ZIP_LS_W03	C1, C2, C3	Wy1, Wy2, Wy3, Wy4, Wy5, Wy6, Wy7, Wy8	N1, N2, N3,

PEK_U02, PEK_U03, PEK_K01, PEK_K02, PEK_K03	K2ZIP_K02, K2ZIP_K03, K2ZIP_K04, K2ZIP_K05, K2ZIP_LS_U04, K2ZIP_LS_U05, K2ZIP_LS_U06, K2ZIP_LS_U07, K2ZIP_LS_U09	C2, C3,	Pr1, Pr2, Pr3, Pr4, Pr5, Pr5, Pr6, Pr7, Pr8	N4, N5
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SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

### SUBJECT CARD

Name in Polish: **Zarządzanie eksploatacją systemów logistycznych**

Name in English: **Management of logistic systems exploitation performance**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Practical Logistics**

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

Kind of subject: **obligatory**

Subject code: **ZPM041105**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30			15	
Number of hours of total student workload (CNPS)	60			60	
Form of crediting	Examination			Crediting with grade	
Group of courses					
Number of ECTS points	2			2	
including number of ECTS points for practical (P) classes				2	
including number of ECTS points for direct teacher-student contact (BK) classes	1.2			1.4	

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

1. has a basic knowledge in the areas of management, logistic processes/systems performance design and testing
2. has a basic knowledge in the field of operations research
3. has a basic knowledge in the field of spreadsheet using, e.g. Excel

### SUBJECT OBJECTIVES

- C1. The acquisition of the basic knowledge in the areas of theory of exploitation and reliability of technical systems and their supporting systems.
- C2. Acquiring the ability to use the main maintenance methods.
- C3. Acquiring the ability to solve the real-life problems, which may affect the effective performance of logistics processes being performed in exploitation systems.

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Has a basic knowledge in the field of exploitation, dependability and durability of technical systems (including logistic systems).

PEK\_W02 - Acquiring the knowledge necessary to plan exploitation processes for a specified type of systems and ability to their design and modification.

PEK\_W03 - Acquiring the knowledge in the field of renewal processes management.

### II. Relating to skills:

PEK\_U01 - Acquiring the ability to use the statistical tools (e.g. RAMS tools) for the assessment of technical systems in the field of their exploitation processes performance

PEK\_U02 - Acquiring the ability to define the main reliability characteristics of technical objects, including logistic objects

### III. Relating to social competences:

PEK\_K01 - Can think and act in a creative and enterprising way

PEK\_K02 - Able to prioritize appropriately for specific tasks and problems

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction to the technical object exploitation problems - the main terms and definitions. Technical system logistics.	2
Lec2	System of operation and maintenance and its models. Maintenance and operation conditions.	2
Lec3	Equipment exploitation process. Exploitation state and the set of exploitation states of equipment.	2
Lec4	Exploitation time and distribution of equipment exploitation time. Indicators, assessment characteristics.	2
Lec5	Maintenance and operation process of machines and equipment used in logistics.	2
Lec6	Tools and methods of technical object failure analysis.	2
Lec7	Cause and types of failures.	2
Lec8	Elements of theory of reliability - the main terms, object failure, reliability structure, dependability assessment.	2
Lec9	Technical system renewal. Scope and objectives of technical systems maintenance.	2
Lec10	Maintenance strategies and operating and maintenance prevention. Potential for the operation and maintenance.	2
Lec11	Elements of operational activities in the logistics of technical systems supporting.	2
Lec12	Maintenance of spare parts inventory.	2
Lec13	Costs in maintenance and operation process performance.	2
Lec14	Withdrawal from the use of the object. Disposal and recycling.	2
Lec15	Management tools used in maintenance and operation process performance.	2

		Total hours: 30
Form of classes – Project		Number of hours
Proj1	Introduction to the project course. Reliability analysis of technical objects (e.g. evaluation of reliability/unreliability functions, failure intensity)	3
Proj2	The use of conformance tests to assess the reliability of technical objects	2
Proj3	Analysis of technical objects reliability structure, definition of optimal warranty period for the specified assumptions	2
Proj4	Maintenance strategy selection with taking into account economic and reliability criteria	2
Proj5	Problem of technical maintenance scheduling with taking into account forecasting number of failures and assessment of maintenance costs of technical object	2
Proj6	Repairman problem	2
Proj7	Technical object reliability analysis with the use of FTA method	2
		Total hours: 15

#### TEACHING TOOLS USED

- N1. multimedia presentation
- N2. problem discussion
- N3. tutorials
- N4. self study - preparation for project class
- N5. self study - self studies and 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	A positive evaluation of the written test with possible oral exam
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_U01, PEK_U02	written test
F2	PEK_U01, PEK_U02, PEK_K01, PEK_K02	a positive evaluation of the tasks performed during the project classes
P = (1/2)F1+(1/2)F2		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. Borkowski S., Selejdak J., Salamon Sz., Efektywność eksploatacji maszyn i urządzeń, Sekcja Wydawnicza Wydziału Zarządzania Politechniki Częstochowskiej, Częstochowa, 2006
2. Dwiliński L., Wstęp do teorii eksploatacji obiektu technicznego, Wyd. Politechniki Warszawskiej, Warszawa 1991
3. Figurski J., Podstawy eksploatacji obiektów technicznych, Międzyresortowe Centrum Naukowe Eksploatacji Majątku Trwałego, Radom 1990
4. Gołabek A., Eksploatacja i niezawodność maszyn, Politechnika Wroclawska skrypt, Wrocław 1988
5. Kazimierczak J., Eksploatacja systemów technicznych. Wyd. Politechniki Śląskiej, Gliwice 2000
6. Legutko S., Eksploatacja maszyn. Wyd. PP, Poznań 2007
7. Niziński S., Elementy eksploatacji obiektów technicznych. Wyd. Uniwersytetu Warmińsko-Mazurskiego, Olsztyn 2000
8. Nowakowski T. Niezawodność systemów logistycznych. Wyd. PWr. Wrocław 2011
9. Oziemski S., Efektywność eksploatacji maszyn. BPE, Radom ITE, Warszawa 1999
10. Ważyńska-Fiok K., Niezawodność systemów technicznych , PWN, Warszawa 1990

SECONDARY LITERATURE

1. Bobrowski D., Modele i metody matematyczne teorii niezawodności w przykładach i zadaniach, WNT, Warszawa 1985
2. Chaberek M.: Makro i mikroekonomiczne aspekty wsparcia logistycznego. Wydawnictwo Uniw. Gdańskiego, Gdańsk 2002
3. Grabski F., Jaźwiński J., Funkcje o losowych argumentach w zagadnieniach niezawodności, bezpieczeństwa i logistyki, WKŁ, Warszawa 2009
4. Nowakowski T., Metodyka prognozowania niezawodności obiektów mechanicznych, Wyd. PWr., Wrocław 1999
5. Szopa T., Niezawodność i bezpieczeństwo, Wyd. Politechniki Warszawskiej, Warszawa 2009

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Management of logistic systems exploitation performance**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_LS_W06	C1, C3	Lec1, Lec2, Lec3, Lec4, Lec5, Lec6, Lec7, Lec8, Lec9, Lec10, Lec11, Lec12, Lec13, Lec14, Lec15	N1, N2, N5
PEK_U01, PEK_U02	K2ZIP_LS_U08	C2, C3	Pr1, Pr2, Pr3, Pr4, Pr5, Pr6, Pr7	N2, N3, N4

PEK_K01, PEK_K02	K2ZIP_LS_K02, K2ZIP_LS_K03	C3	Pr1, Pr2, Pr3, Pr4, Pr5, Pr6, Pr7	N4
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SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

### SUBJECT CARD

Name in Polish: **Automatyczna identyfikacja w systemach logistycznych**

Name in English: **Automatic identification in logistic systems**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Practical Logistics**

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

Kind of subject: **obligatory**

Subject code: **ZPM041106**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15			15	
Number of hours of total student workload (CNPS)	30			30	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	1			1	
including number of ECTS points for practical (P) classes				1	
including number of ECTS points for direct teacher-student contact (BK) classes	0.6			0.7	

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

1. knowledge of logistics.
2. the ability to analyze technical systems.
3. creativity and the ability to open to new solutions activities.

#### SUBJECT OBJECTIVES

- C1. Learning the problems of automatic exchange of information: the classification of automatic identification systems, basic concepts and principles of selection.
- C2. Knowledge of the construction and use of bar codes: types, structure, applications.
- C3. Understanding the principles of RFID tags - varieties, the principle of exchange of data, properties, applications.
- C4. Knowing biometric and anthropometric Auto-ID systems.
- C5. Knowledge of e-signature and its applications in logistics.

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Explain the basic construction of barcodes and explain how they work.

PEK\_W02 - explain the basic construction of RFID tags and explain how they work.

PEK\_W03 - Choose appropriate technologies of automatic identification tasks in logistic systems.

### II. Relating to skills:

PEK\_U01 - To design the appropriate bar code or a radio for the case in the logistic system.

PEK\_U02 - Create appropriate label logistics barcode read information and to process them throughout the supply chain.

PEK\_U03 - Implement selected automatic identification technology in the logistic system.

### III. Relating to social competences:

PEK\_K01 - to understand the need and ability to work in a team

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Providing basic and supplementary literature. Overview of course based on the object card. The term examination of the course. Introduction to the subject. Discussion of the terms "Automatic Identification System", the classification of the Auto-ID systems, the reliability of Auto-ID systems, evaluation criteria of Auto-ID.	2
Lec2	Bar codes, types of construction, use self-check procedures.	2
Lec3	Tags logistics, construction, identifiers applications, the structure of the special tags such global .: GLN GSRN, GRAI, SSCC.	2
Lec4	Electronic cards, variety, use transponders - variety, use properties, structure information, encoders. ECP.	2
Lec5	Biometrics and anthropometric Auto-ID systems.	2
Lec6	Electronic signature (e-signature) and Electronic Data Interchange (EDI called. Electronic Data Interchange)	3
Lec7	Systems OMR, OCR, ICR.	2
		Total hours: 15
Form of classes – Project		Number of hours
Proj1	Presentation of the assumptions in system design and automatic identification of selected goods with the use of GS1 standards-POLAND, allowing you to monitor any unit Piecing goods throughout the supply chain: from the manufacturer warehouse to the store shelf.	2
Proj2	Discussion of opportunities and constraints editor barcode Exercises in editing the various codes.	2
Proj3	Drafting of the label code of the goods piece concept.	2
Proj4	Drafting of the bar code label on the packaging.	2
Proj5	Drafting of transport label on the shipping container - europallet, according to the styandardem GS-1 and the 2D symbology QR code.	2

Proj6	Drafting of the label affixed to the center of the long-distance transport, such as .: a truck, a railway wagon.	2
Proj7	Testing integrated action developed sub-projects, presentation and discussion in groups of Students.	3
		Total hours: 15

#### TEACHING TOOLS USED

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

#### 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	test
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_U01, PEK_U02, PEK_U03, PEK_K01	preparation for the project, participate in discussions problem, the defense of the project.
P = F1		

#### PRIMARY AND SECONDARY LITERATURE

### PRIMARY LITERATURE

1] Krawczyk, S. (ed.): "Logistics. Theory and Practice", DIFIN, Warsaw, 2011

[1] Kwaśniewski S. (ed.), Hare, P. (eds.): "Automatic identification in logistics systems", University of Technology Press, Series 16 Navigator Wrocław, 2004

[2] Pr. Coll. Barcodes. Publisher ILiM. Poznań 2001

[3] Molski M, Kubas M .; Electronic cards. MIKON Warsaw 2002

### SECONDARY LITERATURE

magazines:

- Logistics,

- SCAN - TECH (available in hard copy in the library of the Faculty of Mechanical w / w).

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Automatic identification in logistic systems**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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_W01	K2ZIP_LS_W03, K2ZIP_LS_W05	C1, C2, C3, C4, C5	Wy1, Wy2, Wy3, Wy4, Wy5, Wy6, Wy7	N1, N2, N5,
PEK_U01, PEK_U02, PEK_U03, PEK_K01	K2ZIP_K04, K2ZIP_LS_U06, K2ZIP_LS_U09, K2ZIP_LS_U11	C1, C2, C3, C4, C5	Pr1, Pr2, Pr3, Pr4, Pr5, Pr6,	N3, N4

SUBJECT SUPERVISOR

dr inż. Paweł Zajac tel.: 71 320-27-19 email: pawel.zajac@pwr.edu.pl

Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Logistyka łańcuchów dostaw**

Name in English: **Supply chain logistics**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Quality Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041107**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30				15
Number of hours of total student workload (CNPS)	60				30
Form of crediting	Examination				Crediting with grade
Group of courses					
Number of ECTS points	2				1
including number of ECTS points for practical (P) classes					1
including number of ECTS points for direct teacher-student contact (BK) classes	1.2				0.7

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

1. has a basic knowledge in the areas of management, logistic processes/systems performance design and testing

### SUBJECT OBJECTIVES

C1. Understanding the issues of making strategic and operational decisions in the development of logistics and operation of external supply chains operating in a competitive market environment.

C2. Acquiring the ability to plan and organize the flow of material and information in procurement and distribution processes.

C3. Acquiring the ability to obtain information from the literature, databases, and other sources in order to prepare research paper on a selected topic

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - It has an extended knowledge of the research, design, and supply chain management, especially in the phases of the supply and distribution

PEK\_W02 - Can identify cooperation and integration processes in supply chains for reference desired economic results of the enterprise

### II. Relating to skills:

PEK\_U01 - Can use a properly chosen information and communication technologies in order to analyze and assess the supply chains performance level

PEK\_U02 - Has the ability to use methods of improving the efficiency of the logistics system

### III. Relating to social competences:

PEK\_K01 - Able to interact and work in a group

PEK\_K02 - Can think and act in a creative way

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Supply chains. Supply chain management.	2
Lec2	Logistic cooperation in the area of supply chain management	2
Lec3	Supply chain management. The basic methods, tools and management concepts. The quality of logistics processes	4
Lec4	The role of information and information systems in supply chain management	2
Lec5	The assessment of the integrated logistics chain performance level.	4
Lec6	Integrated logistics chain performance design	4
Lec7	Network organization and virtual organization.	2
Lec8	The costs and their reduction in supply chain management	2
Lec9	Directions and concepts of improvement of supply chain management.	4
Lec10	Development trends of supply chains.	4
		Total hours: 30
Form of classes – Seminar		Number of hours
Sem1	Discussion of basic concepts and premises development of logistics chains. Distribution of seminar topics for group preparation by students.	2
Sem2	The integration and coordination of activities in the supply chain. The cooperation in an integrated supply chain.	2
Sem3	Time management, customer relations management and quality management in supply chains	2
Sem4	Information systems supporting supply chain management.	2
Sem5	Methods for assessing the level of an integrated supply chain performance.	2
Sem6	Logistics network design. Suppliers evaluation and selection process.	2

Sem7	Directions and concepts of improvement of supply chain management. Development trends of supply chains. Summary of seminar activities.	3
		Total hours: 15

TEACHING TOOLS USED		
N1. multimedia presentation		
N2. problem discussion		
N3. tutorials		
N4. self study - preparation for seminar		
N5. self study - self studies and 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	written exam, with the possibility of additional oral answer
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Seminar)		
Evaluation (F – forming (during semester), P – concluding (at semester end))	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_K01, PEK_K02, PEK_U01, PEK_U02,	preparation of a study on a selected topic
F2	PEK_K01, PEK_K02, PEK_U01, PEK_U02,	preparation of seminar presentation on a selected topic
P = (1/2)F1+(1/2)F2		

PRIMARY AND SECONDARY LITERATURE		
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## PRIMARY LITERATURE

1. Bozarth C.C., Handfield R.B., Wprowadzenie do zarządzania operacjami i łańcuchem dostaw: kompletny podręcznik logistyki i zarządzania dostawami, Helion, Gliwice 2007
2. Christopher M., Logistyka i zarządzanie łańcuchem podaży. Jak obniżyć koszty i poprawić jakość obsługi, Wydawnictwo Profesjonalnej Szkoły Biznesu, Kraków 1998.
3. Christopher M., Strategia zarządzania dystrybucją. Praktyka logistyki biznesu, Agencja Wydawnicza "Placet", Warszawa 1996.
4. Coyle J.J., Bardi E.J., Langley Jr C.J., Zarządzanie logistyczne, PWE, Warszawa 2002.
5. Kisperska-Moroń D. (red.), Pomiar funkcjonowania łańcuchów dostaw, Wydawnictwo AE w Katowicach, Katowice 2006.
6. Logistyka on-line. Zarządzanie łańcuchem dostaw w dobie gospodarki elektronicznej, praca zbiorowa pod red. K. Rutkowskiego, PWE Warszawa 2002.
7. Rutkowski K. (red.), Logistyka dystrybucji. Specyfika, tendencje rozwojowe, dobre praktyki, Oficyna Wydawnicza SGH, Warszawa 2005.
8. Rutkowski K. (red.), Zintegrowany łańcuch dostaw. Doświadczenia globalne i polskie, praca zbiorowa pod red. K. Rutkowskiego, SGH, Warszawa 1999.
9. Witkowski J., Zarządzanie łańcuchem dostaw. Koncepcje, procedury, doświadczenia, PWE Warszawa 2003.

## SECONDARY LITERATURE

1. Chopra S., Meindl P., Supply Chain Management. Strategy, Planning and Operation, Prentice-Hall, Inc., Upper Saddle River, New Jersey 2001.
2. Handfield R.B., Nichols E.L. Jr, Introduction to Supply Chain Management, Prentice Hall, New Jersey 1999.
3. Knolmayer G., Mertens P., Zeier A., Supply Chain Management Based on SAP Systems. Order Management in Manufacturing Companies, Springer-Verlag Berlin Heidelberg 2002.
4. Simchi-Levi D., Kaminsky P., Simchi-Levi E., Designing and Managing the Supply Chain. Concepts, Strategies and Case Studies, The McGraw-Hill Companies, Inc. 2000.

**MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
Supply chain logistics  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
Management and Manufacturing Engineering**

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	K2ZIP_ZJ_W10	C1, C2	Wy1, Wy2, Wy3, Wy4, Wy5, Wy6, Wy7, Wy8, Wy9, Wy10	N1, N2, N5
PEK_U01, PEK_U02	K2ZIP_ZJ_U05, K2ZIP_ZJ_U10	C1, C2, C3	Se1, Se2, Se3, Se4, Se5, Se6, Se7	N1, N2, N3, N4
PEK_K01, PEK_K02	K2ZIP_K03, K2ZIP_ZJ_K04	C3	Se1, Se2, Se3, Se4, Se5, Se6, Se7	N4

SUBJECT SUPERVISOR





Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Logistyka łańcuchów dostaw**

Name in English: **Supply chain logistics**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Practical Logistics**

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

Kind of subject: **obligatory**

Subject code: **ZPM041107**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30				15
Number of hours of total student workload (CNPS)	60				30
Form of crediting	Examination				Crediting with grade
Group of courses					
Number of ECTS points	2				1
including number of ECTS points for practical (P) classes					1
including number of ECTS points for direct teacher-student contact (BK) classes	1.2				0.7

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

1. has a basic knowledge in the areas of management, logistic processes/systems performance design and testing
2. has a basic knowledge in the area of logistic processes performance modelling

### SUBJECT OBJECTIVES

- C1. Understanding the issues of making strategic and operational decisions in the development of logistics and operation of external supply chains operating in a competitive market environment.
- C2. Acquiring the ability to plan and organize the flow of material and information in procurement and distribution processes.
- C3. Acquiring the ability to obtain information from the literature, databases, and other sources in order to prepare research paper on a selected topic

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - It has an extended knowledge of the research, design, and supply chain management, especially in the phases of the supply and distribution

PEK\_W02 - Can identify cooperation and integration processes in supply chains for reference desired economic results of the enterprise

### II. Relating to skills:

PEK\_U01 - Can use a properly chosen information and communication technologies in order to analyze and assess the supply chains performance level

PEK\_U02 - Has the ability to use methods of improving the efficiency of the logistics system

### III. Relating to social competences:

PEK\_K01 - Able to interact and work in a group

PEK\_K02 - Can think and act in a creative way

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Supply chains. Supply chain management.	2
Lec2	Logistic cooperation in the area of supply chain management.	2
Lec3	Supply chain management. The basic methods, tools and management concepts.	2
Lec4	Supply chain strategy	2
Lec5	Creation of models of strategy and business location.	2
Lec6	The role of information and information systems in supply chain management	2
Lec7	The assessment of the integrated logistics chain performance level.	2
Lec8	Effectiveness of integrated logistic chain performance.	2
Lec9	Integrated logistics chain performance design.	2
Lec10	Risk management in supply chains.	2
Lec11	Directions and concepts of improvement of supply chain management.	2
Lec12	Network organization and virtual organization.	2
Lec13	The costs and their reduction in supply chain management	2
Lec14	Directions and concepts of improvement of supply chain management.	2
Lec15	Benchmarking and reengineering in logistics.	2
		Total hours: 30
Form of classes – Seminar		Number of hours
Sem1	Discussion of basic concepts and premises development of logistics chains. Distribution of seminar topics for group preparation by students.	2
Sem2	The integration and coordination of activities in the supply chain. The cooperation in an integrated supply chain (integration levels, cooperations rules, CPFR, needs identification, demand planning, etc.)	2

Sem3	Time management, customer relations management and quality management in supply chains	2
Sem4	Information systems supporting supply chain management.	2
Sem5	Methods for assessing the level of an integrated supply chain performance.	2
Sem6	Logistics network design. Suppliers evaluation and selection process.	2
Sem7	Directions and concepts of improvement of supply chain management. Development trends of supply chains. Summary of seminar activities.	3
		Total hours: 15

TEACHING TOOLS USED	
<p>N1. multimedia presentation  N2. problem discussion  N3. tutorials  N4. self study - preparation for seminar  N5. self study - self studies and preparation for examination</p>	

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	written exam, with the possibility of additional oral answer
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Seminar)		
Evaluation (F – forming (during semester), P – concluding (at semester end))	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_K01, PEK_K02, PEK_U01, PEK_U02,	preparation of a study on a selected topic
F2	PEK_K01, PEK_K02, PEK_U01, PEK_U02,	preparation of seminar presentation on a selected topic
P = (1/2)F1+(1/2)F2		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. Bozarth C.C., Handfield R.B., Wprowadzenie do zarządzania operacjami i łańcuchem dostaw: kompletny podręcznik logistyki i zarządzania dostawami, Helion, Gliwice 2007
2. Christopher M., Logistyka i zarządzanie łańcuchem podaży. Jak obniżyć koszty i poprawić jakość obsługi, Wydawnictwo Profesjonalnej Szkoły Biznesu, Kraków 1998.
3. Christopher M., Strategia zarządzania dystrybucją. Praktyka logistyki biznesu, Agencja Wydawnicza "Placet", Warszawa 1996.
4. Coyle J.J., Bardi E.J., Langlely Jr C.J., Zarządzanie logistyczne, PWE, Warszawa 2002.
5. Kisperska-Moroń D. (red.), Pomiar funkcjonowania łańcuchów dostaw, Wydawnictwo AE w Katowicach, Katowice 2006.
6. Logistyka on-line. Zarządzanie łańcuchem dostaw w dobie gospodarki elektronicznej, praca zbiorowa pod red. K. Rutkowskiego, PWE Warszawa 2002.
7. Rutkowski K. (red.), Logistyka dystrybucji. Specyfika, tendencje rozwojowe, dobre praktyki, Oficyna Wydawnicza SGH, Warszawa 2005.
8. Rutkowski K. (red.), Zintegrowany łańcuch dostaw. Doświadczenia globalne i polskie, praca zbiorowa pod red. K. Rutkowskiego, SGH, Warszawa 1999.
9. Witkowski J., Zarządzanie łańcuchem dostaw. Koncepcje, procedury, doświadczenia, PWE Warszawa 2003.

SECONDARY LITERATURE

1. Chopra S., Meindl P., Supply Chain Management. Strategy, Planning and Operation, Prentice-Hall, Inc., Upper Saddle River, New Jersey 2001.
2. Handfield R.B., Nichols E.L. Jr, Introduction to Supply Chain Management, Prentice Hall, New Jersey 1999.
3. Knolmayer G., Mertens P., Zeier A., Supply Chain Management Based on SAP Systems. Order Management in Manufacturing Companies, Springer-Verlag Berlin Heidelberg 2002.
4. Simchi-Levi D., Kaminsky P., Simchi-Levi E., Designing and Managing the Supply Chain. Concepts, Strategies and Case Studies, The McGraw-Hill Companies, Inc. 2000.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Supply chain logistics**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_LS_W01	C1, C2	Wy1, Wy2, Wy3, Wy4, Wy5, Wy6, Wy7, Wy8, Wy9, Wy10, Wy11, Wy12, Wy13, Wy14, Wy15,	N1, N2, N5
PEK_U01, PEK_U02	K2ZIP_LS_U01, K2ZIP_LS_U02	C1, C2, C3	Se1, Se2, Se3, Se4, Se5, Se6, Se7	N1, N2, N3, N4
PEK_K01, PEK_K02	K2ZIP_K03, K2ZIP_LS_K01	C3	Se1, Se2, Se3, Se4, Se5, Se6, Se7	N4

SUBJECT SUPERVISOR

dr inż. Sylwia Werbińska-Wojciechowska tel.: 71 320-34-27 email: Sylwia.Werbinska@pwr.edu.pl

Faculty of Mechanical Engineering

### SUBJECT CARD

Name in Polish: **Systemy komputerowego wspomagania logistyki (CAL)**

Name in English: **Computer aided logistics**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Practical Logistics**

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

Kind of subject: **obligatory**

Subject code: **ZPM041108**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30			15	
Number of hours of total student workload (CNPS)	60			60	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	2			2	
including number of ECTS points for practical (P) classes				2	
including number of ECTS points for direct teacher-student contact (BK) classes	1.2			1.4	

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

1. Basic knowledge of management, design and analysis of logistics processes/systems.
2. Basic knowledge of spreadsheet (eg. Excel).

#### SUBJECT OBJECTIVES

- C1. The course aims to introduce students to the subject of systems supporting enterprise management, in case of logistics and transport support. Presentation of basic terms related to computer systems, their classification and rules for the selection, implementation and operation.
- C2. Presentation of the principles of electronic data interchange (EDI) in the logistics chain.
- C3. Presentation and provide knowledge on the use of computer simulation to solve problems in the area of logistics interests.
- C4. Teaching work in a group in the implementation of selected projects.

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - The student has a basic knowledge of the latest IT solutions supporting management of warehouse and fleet.

PEK\_W02 - The student has an extended knowledge of the use of computer simulation methods to solve problems in the area of transport and logistics.

### II. Relating to skills:

PEK\_U01 - The student is able to use computer tools, in particular the computer simulation for analysis, rating and improvement of existing technologies in the area of enterprises in the TSL.

PEK\_U02 - The student is able to perform the model of logistics process using the tools to develop a computer simulation (Flexsim Software).

### III. Relating to social competences:

PEK\_K01 - The student is able to work in a group, organize and plan the way to perform work, can take different roles and functions.

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction, basic concepts Zag. 1. Information, system, information system and information technology, enterprise management systems, their structure and development path. Zag. 2. Presentation of the principles of electronic data interchange (EDI) in the logistics chain, its use in the cargo transport. Zag. 3. Overview of available software.	2
Lec2	Logistics and transportation problems solving, using tools for computer simulations (Flexsim Software). Issue 1: Discussion of the principles of computer simulation and possibilities of using simulation models in logistics. Issue 2: An introduction to the Flexsim Software, object-oriented modeling.	2
Lec3	Logistics and transportation problems solving, using tools for computer simulations (Flexsim Software). Issue 1: Programming the basic logic functions, global tables and labels.	2
Lec4	Logistics and transportation problems solving, using tools for computer simulations (Flexsim Software). Issue 1: Programming the kinematics of objects.	2
Lec5	Logistics and transportation problems solving, using tools for computer simulations (Flexsim Software). Issue 1: Introduction to use task sequence.	2
Lec6	Logistics and transportation problems solving, using tools for computer simulations (Flexsim Software). Issue 1: Modeling fluid objects.	2
Lec7	Logistics and transportation problems solving, using tools for computer simulations (Flexsim Software). Issue 1: Triggers	2



Lec8	Logistics and transportation problems solving, using tools for computer simulations (Flexsim Software). Issue 1: Flexsim coding - writing logic in Flexsim (variable types, math operations, comparing variables, relating variables)	2
Lec9	Logistics and transportation problems solving, using tools for computer simulations (Flexsim Software). Issue 1: Flexsim coding - basic modeling functions (object referencing, object attributes, object statistics)	2
Lec10	Logistics and transportation problems solving, using tools for computer simulations (Flexsim Software). Issue 1: Flexsim coding - basic modeling functions (object labels, object control, object variables, tables)	2
Lec11	Logistics and transportation problems solving, using tools for computer simulations (Flexsim Software). Issue 1: Flexsim coding - advanced functions (eg. excel commands)	2
Lec12	Logistics and transportation problems solving, using tools for computer simulations (Flexsim Software). Issue 1: Charting and reporting.	2
Lec13	Logistics and transportation problems solving, using tools for computer simulations (Flexsim Software). Issue 1: Experimenter.	2
Lec14	Logistics and transportation problems solving, using tools for computer simulations (Flexsim Software). Issue 1: Optimizer.	2
Lec15	Examination of the subject	2
		Total hours: 30
Form of classes – Project		Number of hours
Proj1	Introduction to logistics and transportation problems solving, using tools for computer simulations (Flexsim Software). Issue 1: An introduction to the Flexsim Software, object-oriented modeling.	1
Proj2	Logistics and transportation problems solving, using tools for computer simulations (Flexsim Software). Issue 1: Programming the kinematics of objects. Issue 2: Programming the basic logic functions, global tables and labels.	2
Proj3	Logistics and transportation problems solving, using tools for computer simulations (Flexsim Software). Issue 1: Development of the simulation model of the logistics process (eg. warehouse inventory management process, container terminal).	2
Proj4	Logistics and transportation problems solving, using tools for computer simulations (Flexsim Software). Issue 1: Development of the simulation model of the logistics process (eg. warehouse inventory management process, container terminal).	2
Proj5	Logistics and transportation problems solving, using tools for computer simulations (Flexsim Software). Issue 1: Development of the simulation model of the logistics process (eg. warehouse inventory management process, container terminal).	2
Proj6	Logistics and transportation problems solving, using tools for computer simulations (Flexsim Software). Issue 1: Sensitivity analysis of the model.	2

Proj7	Logistics and transportation problems solving, using tools for computer simulations (Flexsim Software). Issue 1: Interpretation of the results, decision, solution to the problem.	2
Proj8	Examination of the subject	2
		Total hours: 15

TEACHING TOOLS USED

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

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	Final test
F2	PEK_W02	Final test
P = 0,5*F1+0,5*F2		

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	Evaluation of of tasks completed during the course
F2	PEK_U02	Evaluation of simulation model
F3	PEK_K01	Rating timely execution of individual tasks, evaluation of workload in the implementation of group tasks
P = 0,4*F1+0,4*F2+0,2*F3		

PRIMARY AND SECONDARY LITERATURE

### PRIMARY LITERATURE

1. Beaverstock M., Greenwood A., Lavery E. i Nordgren E. tłumaczenie Wróbel G.: Symulacja stosowana: modelowanie i analiza przy wykorzystaniu FlexSim, Rzeszów, Kraków: Cempel Consulting 2012.
2. Klonowski Z.J.: Systemy informatyczne zarządzania przedsiębiorstwem. Modele rozwoju i właściwości funkcjonalne. Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2004.
3. Piotr Adamczewski; Zintegrowane systemy informatyczne w praktyce. Wyd. Mikom, Warszawa 2004

### SECONDARY LITERATURE

1. Wojtochnik R., Elektroniczna wymiana dokumentów. Handel, usługi, logistyka, finanse, wyd. MIKOM, W-wa, 2004
2. Majewski J.: Informatyka dla logistyki. Wyd. ILiM, Poznań 2002

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Computer aided logistics**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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
EK_W01, EK_W02	K2ZIP_LS_W03, K2ZIP_LS_W05, K2ZIP_LS_W08	C1 - C4		N1, N4
PEK_U01	K2ZIP_LS_U04, K2ZIP_LS_U06	C1, C2, C3, C4		N2, N3, N4, N5
PEK_U02	K2ZIP_LS_U10	C3		N3, N4
PEK_K01	K2ZIP_LS_K01, K2ZIP_LS_K02	C5		N2, N3, N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Systemy konfekcjonowania i przechowywania materiałów**

Name in English: **System of confectioning and materials storage**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Practical Logistics**

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

Kind of subject: **obligatory**

Subject code: **ZPM041109**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15				15
Number of hours of total student workload (CNPS)	60				30
Form of crediting	Examination				Crediting with grade
Group of courses					
Number of ECTS points	2				1
including number of ECTS points for practical (P) classes					1
including number of ECTS points for direct teacher-student contact (BK) classes	1.2				0.7

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

**I. Relating to knowledge:**

**II. Relating to skills:**

**III. Relating to social competences:**

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1		2
Lec2		2
Lec3		2
Lec4		2
Lec5		2
Lec6		2
Lec7		2
Lec8		1
		Total hours: 15
Form of classes – Seminar		Number of hours
Sem1		2
Sem2		2
Sem3		2
Sem4		2
Sem5		2
Sem6		2
Sem7		2
Sem8		1
		Total hours: 15

TEACHING TOOLS USED
<p>N1. traditional lecture with the use of transparencies and slides  N2. problem discussion  N3. multimedia presentation</p>

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, K01, PEK_K02	
P = 100%*F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Seminar)

Evaluation (F – forming (during semester), P – concluding (at semester end))	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01, PEK- K01, PEK_K02	
F2	PEK_U01, PEK- K01, PEK_K02	
P = 50%*F1+50%*F2		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**System of confectiioning and materials storage**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_LS_W01, K2ZIP_LS_W02	C1, C2, C3, C4		N1, N2, N3
PEK_W02	K2ZIP_W11	C2, C3		N1, N2, N3
PEK_U01	K2ZIP_LS_U03, K2ZIP_U01	C2, C3		N2, N3
PEK_K01	K2ZIP_K02	C1, C2, C3, C4		N1, N2, N3
PEK_K02	K2ZIP_K05	C1, C2, C3, C4		N1, N2, N3

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Faculty of Mechanical Engineering

### SUBJECT CARD

Name in Polish: **Systemy transportowe w logistyce**

Name in English: **Transportation systems in logistics**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Practical Logistics**

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

Kind of subject: **obligatory**

Subject code: **ZPM041110**

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	X				
Number of ECTS points	2				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	1.2				

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

1. Student has a basic knowledge of management, design and testing processes / logistics systems.
2. Can formulate major logistical problems occurring in the competitive environment; can apply the appropriate algorithms for analysis and evaluation of alternative logistics solutions.
3. He can think and act in an entrepreneurial way.

### SUBJECT OBJECTIVES

- C1. To familiarize students with the theoretical and practical aspects of functioning of the Polish transport system and its components modes of transport.
- C2. Provide basic knowledge of the characteristics and properties of transport and transport services, economic and social importance of transport, the structure of the transport process and the transport process.
- C3. Knowing tasks, Infrastructure various modes of transport: rail, road, air, sea, pipeline and inland waterways.

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Explains the characteristics of the transport system.

PEK\_W02 - It is characterized by parameters for assessing the transport process.

### II. Relating to skills:

### III. Relating to social competences:

PEK\_K01 - He can think and act in a creative and enterprising.

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	The scope of the lecture, Assessment, literature. Definitions, properties and characteristics of transport and the transport service.	2
Lec2	Economic and social importance of transport. Transport needs and sources of their formation. The functions of transport.	2
Lec3	Transportation as a subject and a factor of European integration. Transport corridors trans-European network.	2
Lec4	Definitions of the transport system The transport system in a gałęziowym (rail car, air, sea, inland waterway, pipeline, urban).	2
Lec5	Characteristics of particular modes of transport in terms of organization and technology operations.	2
Lec6	Analysis and evaluation of all modes of transport and their involvement in passenger and freight services.	2
Lec7	Quantitative and qualitative evaluation of infrastructure and superstructure of individual modes of transport and their development prospects.	2
Lec8	The structure of the transport process and the transport process. Meters qualitative assessment of the transport process.	2
Lec9	Loading process technology. Rules for selection of means of transport and transport technologies for transport tasks.	2
Lec10	Characteristics of technical and legal implementation of the transport of dangerous goods.	2
Lec11	Results of the oversized cargo transportation	2
Lec12	Characteristics of transportation in the context of other specialized technology	2
Lec13	Characteristics of intermodal transport	2
Lec14	Characteristics of selected technologies intermodal transport	2
Lec15	Final test	2
		Total hours: 30

## TEACHING TOOLS USED



- N1. traditional lecture with the use of transparencies and slides
- N2. multimedia presentation
- N3. problem discussion

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_K01	test
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

[1] Rydzkowski W.: Transport. Wydawnictwa Naukowe PWN, Warszawa 2004. [2] Liberadzki B., Mindur L.: Uwarunkowania rozwoju systemu transportowego Polski. Wydawnictwo Instytut Technicznej Eksploatacji, Radom 2007. [3] Wojewódzka Król K.: Rozwój infrastruktury transportowej. Wydawnictwa Naukowe PWN, Warszawa 2002.

SECONDARY LITERATURE

[1] Mundur L.: Nowoczesne technologie transportowe. PWN, Warszawa 1997. [2] Kwasniowski S., Nowakowski T., Zając M.: Transport intermodalny w sieciach logistycznych, PWR, 2008.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Transportation systems in logistics**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_LS_W01	C1, C2, C3	Wy1 - Wy14	N1, N2, N3
PEK_K01	K2ZIP_LS_K03	C1, C2, C3	Wy1 - Wy15	N1, N2, N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Praca przejściowa**

Name in English: **Pre-final project**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Practical Logistics**

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

Kind of subject: **obligatory**

Subject code: **ZPM041111**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)				45	
Number of hours of total student workload (CNPS)				120	
Form of crediting				Crediting with grade	
Group of courses					
Number of ECTS points				4	
including number of ECTS points for practical (P) classes				4	
including number of ECTS points for direct teacher-student contact (BK) classes				2.8	

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

1. Student has knowledge of the basics of logistics, logistics processes, modeling of logistics processes.
2. Can analyze the system and the logistics process for its functioning.

### SUBJECT OBJECTIVES

- C1. Familiarizing yourself with the analysis and modeling of complex systems and logistics processes.
- C2. Acquisition of the ability to analyze the functioning of systems and logistics processes and perform their optimization.
- C3. Acquiring the ability perform simple mathematical models and simulation wybranego system and the logistics process of the restrictions.

SUBJECT EDUCATIONAL EFFECTS

**I. Relating to knowledge:**

**II. Relating to skills:**

PEK\_U01 - Student can develop a logistics system model using the methods of system analysis and computer tools.

**III. Relating to social competences:**

PEK\_K01 - Acquire the ability to take on responsibility for their work. Acquire the ability to think and act creatively. Acquires the ability to work in a team.

PROGRAMME CONTENT

Form of classes – Project		Number of hours
Proj1	Presentation of the purpose and scope of the work transition, the administration proposed topics.	3
Proj2	Getting to know the actual functioning logistics system (feasible in the form of field trips).	3
Proj3	Analysis of existing solutions conceptual model of the range of systems and logistics processes.	3
Proj4	Analysis of concept solutions to the problems identified in the area of the analyzed system or process logistics, assumptions, development of test protocols.	3
Proj5	Field measurements (quantitative) functioning logistics system. Part I.	3
Proj6	Field measurements (quantitative) functioning logistics system. Part II.	3
Proj7	Field measurements (quantitative or qualitative) functioning logistics system. Part III.	3
Proj8	Development of analytical model of the logistics system takes into account the accepted limit.	3
Proj9	The development of the logistics system simulation model takes into account the accepted limit. Part I.	3
Proj10	The development of the logistics system simulation model takes into account the accepted limit. Part II.	3
Proj11	Developing characteristics obtained from the simulation model and the actual system.	3
Proj12	Analysis of the compatibility of the analytical model and simulation with actual data.	3
Proj13	The sensitivity analysis model developed logistics system.	3
Proj14	Optimization model of logistics system due to the specified size.	3
Proj15	Presentation of the results obtained.	3

## TEACHING TOOLS USED

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

## 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_K01	average ratings of the various stages project
F2	PEK_U01, PEK_K01	evaluation of the project
F3	PEK_U01, PEK_K01	Activity in the discussion during the project
$P = 0,4 \cdot F1 + 0,4 \cdot F2 + 0,2 \cdot F3$		

## PRIMARY AND SECONDARY LITERATURE

## PRIMARY LITERATURE

1. Bozarth C., Handfield R.B., „Wprowadzenie do zarządzania operacjami i łańcuchem dostaw”, Wyd. Helion S.A., Gliwice, 2007
2. Brzeziński M., „Logistyka w przedsiębiorstwie”, Wyd. Bellona, Warszawa, 2006
3. Chaberek M., „Rachunek decyzyjny w logistyce zaopatrzenia”, Wyd. GWSH, Gdańsk, 2002
4. Kowalska K., „Logistyka Zaopatrzenia”, Wydawnictwo Akademii Ekonomicznej, Katowice, 2005
5. Krawczyk S., „Zarządzanie procesami logistycznymi”, Wyd. PWE, Warszawa, 2001
6. Sarjusz - Wolski Z., „Strategia Zarządzania Zaopatrzeniem”, Wyd. PLACET, Warszawa, 1998
7. Twaróg J., „Mierniki i Wskaźniki Logistyczne”, Wyd. Instytut Logistyki i Magazynowania, Poznań, 2003
8. Vollmuth H.J., „Controlling. Instrumenty od A do Z”, Wyd. Placet, Warszawa, 1995
9. Witkowski J., „Zarządzanie Łańcuchem Dostaw”, Wyd. PWE, Warszawa, 2010
10. Wojciechowski T., „Zarządzanie sprzedażą i zakupem materiałów”, Wyd. PWE, Warszawa, 1999
11. Lyons, Kenneth. "Zakupy zaopatrzeniowe", PWE, Warszawa 2004

## SECONDARY LITERATURE

1. Blanchard B. S.: Logistics Engineering and Management (5th Ed). Upper Saddle River: Pearson Prentice Hall, 2004
2. Dąbrowska - Mitek M., „Ocena dostawców w przedsiębiorstwach handlowych”, - Problemy Jakości, Luty 2007
3. Mańkowski C., „Kontroling i logistyka zaopatrzenia jako czynniki synergiczne gospodarowania”, Wyd. UW, Gdańsk, 2005
4. Pfohl H.Ch., „Systemy Logistyczne”, Wyd. Instytut Logistyki i Magazynowania, Poznań, 2001
5. Pfohl H.Ch., „Zarządzanie logistyką”, Wyd. Instytut Logistyki i Magazynowania, Poznań, 1998
6. Wolniak R., Skotnicka - Zasadzień B., „Wybrane metody badania satysfakcji klienta i oceny dostawców w organizacjach”, Wydawnictwo Politechniki Śląskiej, Gliwice, 2008

Czasopisma:

1. The International Journal of Logistics Management
2. International Journal of Physical Distribution & Logistics Management
3. Journal of Business Logistics
4. Gospodarka Materiałowa i Logistyka
5. Logistics and Transport
6. Logistyka

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Pre-final project**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_LS_U01, K2ZIP_LS_U02, K2ZIP_LS_U06, K2ZIP_LS_U07, K2ZIP_LS_U10	C1-C3	Pr1-Pr15	N1-N4
PEK_K01	K2ZIP_LS_K01, K2ZIP_LS_K02, K2ZIP_LS_K03	C1-C3	Pr1-Pr15	N1-N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Rachunek kosztów w logistyce**

Name in English: **Costing account in logistics**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Practical Logistics**

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

Kind of subject: **obligatory**

Subject code: **ZPM041112**

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	Examination				
Group of courses					
Number of ECTS points	2				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	1.2				

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

1. knowledge in the area of logistics procurement, production, distribution and warehouse management
2. knowledge of the traditional cost accounting
3. knowledge of the logistic and cost performance measurement

### SUBJECT OBJECTIVES

- C1. Obtainment the ability to identify costs in various logistic systems in the enterprise
- C2. Obtainment of knowledge concerning the causes of logistic costs
- C3. Obtainment of knowledge concerning planning and control logistic costs
- C4. Obtainment of knowledge concerning cost accounting process and its application in logistics

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Student has an extended knowledge of research, planning and control logistics costs in the management of logistics chains, particularly in phases of the supply and distribution

PEK\_W02 - Student has an extended knowledge of the impact of techniques and technology, material flow and storage at enterprise logistics costs

### II. Relating to skills:

### III. Relating to social competences:

PEK\_K01 - Student can appropriately define the priorities for implementation set by them or other tasks and problems

PEK\_K02 - Student can think and act creatively

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	The importance of logistic costs in the enterprise	2
Lec2	Logistic cost management in the enterprise	2
Lec3	Traditional cost accounting and logistic costs	2
Lec4	Identification of the cost of the distribution system	2
Lec5	Cost planning and control distribution system	2
Lec6	Identification of the cost of the procurement process	2
Lec7	Planning and control costs of the procurement process	2
Lec8	Identification, planning and control costs of the storage process	2
Lec9	Identification, planning and control costs of transportation process	2
Lec10	Trade-off relationship and operational activities	2
Lec11	Trade-off relationship in logistic cost management	2
Lec12	Models of production and logistic costs of company	2
Lec13	Activity based costing	2
Lec14	Logistic controlling	2
Lec15	Examples of practical cost solutions in Polish enterprises	2
		Total hours: 30

## TEACHING TOOLS USED

N1. multimedia presentation

N2. problem discussion

N3. problem lecture

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_K01, PEK_K02	WRITTEN EXAM
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1) Biernacki M., Kowalak R., "Rachunek kosztów logistyki w zarządzaniu przedsiębiorstwem", Wydawnictwo UE, Wrocław 20102) Nowak E., Nieplowicz M., "Rachunek kosztów i pomiar dokonań", Wydawnictwo UE, Wrocław 20113) Kaplan R., Anderson S., "Rachunek kosztów działań sterowany czasem - Time-Driven Activity-Based Costing: prostsza i bardziej skuteczna droga do większych zysków", Wydawnictwo Naukowe PWN, Warszawa 20084) Twaróg J., "Koszty logistyki przedsiębiorstw", Wydawnictwo ILiM, Poznań 2003

SECONDARY LITERATURE

1) Twaróg J., "Wskaźniki i mierniki logistyczne", Wydawnictwo ILiM, Poznań 20022) Prymon K., Tubis A., "Controlling i rachunkowość zarządcza", Wydawnictwo NDiO, Wrocław 20113) Śliwczyński B., "Controlling w zarządzaniu logistyką", Wydawnictwo WSL, Poznań 2007

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Costing account in logistics**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_LS_W01	C1, C2, C3, C4	Wy1, Wy2, Wy3, Wy4, Wy5, Wy6, Wy7, Wy8, Wy9	N1, N2, N3
PEK_W02	K2ZIP_LS_W03	C1, C2, C3	Wy4, Wy5, Wy6	N1, N2, N3
PEK_K01	K2ZIP_K05	C1, C2, C3, C4	Wy1, Wy2, Wy3, Wy4, Wy5, Wy6, Wy7, Wy8	N1, N2, N3
PEK_K02	K2ZIP_K03	C1, C2, C3, C4	Wy1, Wy2, Wy3, Wy4, Wy5, Wy6, Wy7, Wy8	N1, N2, N3



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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Logistyka dystrybucji**

Name in English: **Logistics of distribution**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Practical Logistics**

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

Kind of subject: **obligatory**

Subject code: **ZPM041113**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15			15	
Number of hours of total student workload (CNPS)	30			30	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	1			1	
including number of ECTS points for practical (P) classes				1	
including number of ECTS points for direct teacher-student contact (BK) classes	0.6			0.7	

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

1. has a basic knowledge in the areas of management, logistic processes/systems performance design and testing
2. has a basic knowledge in the field of operations research
3. has a basic knowledge in the field of spreadsheet using, e.g. Excel

### SUBJECT OBJECTIVES

- C1. The acquisition of knowledge in the area of systems performance and distribution.
- C2. Acquiring the ability to define the main problems and tasks that occur in the area of distribution logistics.

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - It has an extended knowledge of the research, design, and supply chain management, especially in the phase of distribution

PEK\_W02 - Can identify the processes of cooperation and integration in the supply chain's downstream (relations in: system of production - distribution channel participants - client) to reference the desired economic results of the enterprise

### II. Relating to skills:

PEK\_U01 - Can obtain information from literature, databases and other sources

PEK\_U02 - Able to integrate the information, make their interpretation and critical evaluation, and to draw conclusions and formulate and fully justify opinions

PEK\_U03 - Able to prepare a research study

### III. Relating to social competences:

PEK\_K01 - Able to interact and work in a group

PEK\_K02 - Able to prioritize appropriately for specific tasks and problems

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction to the course. The terms of distribution logistics and distribution system. The essence of logistics distribution. Basic tasks and capabilities in the field of distribution logistics.	2
Lec2	Distribution logistics in the system approach. Distribution strategies. The relationship between the distribution logistics and marketing.	2
Lec3	Planning the distribution network. Distribution channels (direct, indirect). Variants of the organization of distribution processes.	2
Lec4	Distribution requirements planning. Demand forecasting methods. Demand forecasting errors. Demand planning DRP.	2
Lec5	Logistics customer service. Measuring the level of customer service - an indicator of the reliability of supply OTIF (on time, in-full, error free). Cycle of customer orders and the associated information flows.	2
Lec6	The main problems occurring in logistics of distribution.	2
Lec7	Effects and costs in the logistics of distribution (logistics costs, distribution costs). level of supply service. The effectiveness of the distribution system, methodology, criteria and evaluation tools.	2
Lec8	Tools of modern distribution: cross docking, vendor management inventory, effective customer service.	1
		Total hours: 15
Form of classes – Project		Number of hours
Proj1	Introduction to the course. Simulation of the "beer game".	2
Proj2	Managing the flow of finished goods from producer to final consumer - the choice of distribution channels (own task / case study)	2
Proj3	Distribution requirements planning (own task/case study)	2

Proj4	Manufacturer warehouse network as a support for distribution processes performance (own task/case study)	2
Proj5	Location of warehouses - justification for process selection (own task/case study)	2
Proj6	Determination of service regions - intuitive rules and quantitative methods (own task/case study)	2
Proj7	Distribution system effectiveness (own task/case study). Completion of the course.	3
		Total hours: 15

TEACHING TOOLS USED		
N1. multimedia presentation		
N2. problem discussion		
N3. tutorials		
N4. self study - preparation for project class		
N5. self study - self studies and 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	A positive evaluation of the written test
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_U01, PEK_U02, PEK_U03, PEK_K01, PEK_K02	a positive evaluation of the tasks performed during the project classes
F2	PEK_U02, PEK_U03	A positive evaluation of the written test
P = (1/2)F1+(1/2)F2		

PRIMARY AND SECONDARY LITERATURE		
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## PRIMARY LITERATURE

1. Barcik R.: Logistyka dystrybucji. Wydawnictwo ATH, Bielsko-Biała 2005
2. Bozarth C., Handfield R.B.: Wprowadzenie do zarządzania operacjami i łańcuchem dostaw. Wyd. Helion, Gliwice 2007
3. Christopher M.L: Strategia zarządzania dystrybucją. Agencja Wydawnicza Placet, Warszawa 1999
4. J.Coyle, E. Bardi: The Management of Business Logistics. West Publishing Company, 1980
5. Czubała A: Dystrybucja produktów. PWE, 1996
6. Handbook of Logistics & Distribution Management. Pod red. J. Gattorna. Gower, 1994
7. D. Kempny, Logistyczna obsługa klienta, PWE, Warszawa 2001.
8. Krawczyk S.: Metody ilościowe w logistyce (przedsiębiorstwa) t.II, Wydawnictwo C. H. Beck, Warszawa 2001
9. Krawczyk S.: Zarządzanie procesami logistycznymi. PWE, Warszawa 2001
10. Rushton, J. Oxley: Handbook of Logistics and Distribution Management. Kogan Page, 1995
11. Sarjusz-Wolski Z.: Sterowanie zapasami w przedsiębiorstwie. Wyd. PWE, Warszawa 2000
12. Sarjusz-Wolski Z.: Strategia zarządzania zaopatrzeniem: Praktyka logistyki biznesu. Wyd. "Placet", Warszawa 1998
13. Stern L.W., El-Ansary A.I., Coughlan A.T.: Kanaly marketingowe. Wydawnictwo Naukowe PWN, Warszawa 2002.

## SECONDARY LITERATURE

1. Blanchard B. S.: Logistics Engineering and Management (5th Ed). Upper Saddle River: Pearson Prentice Hall, 2004
  2. M. Christopher: The Customer Service Planner. Butterworth-Heinemann, 1992
  3. Grajewski P.: Organizacja procesowa. PWE, Warszawa 2007
  4. McKinnon A: Physical Distribution Systems. Routledge, 1989
  5. Mokrzyński H.: Logistyka: podstawy procesów logistycznych. WIG, Białystok 1998
- Czasopisma:
1. The International Journal of Logistics Management
  2. International Journal of Physical Distribution & Logistics Management
  3. Journal of Business Logistics
  4. Gospodarka Materiałowa i Logistyka
  5. Logistyka

**MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
Logistics of distribution  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
Management and Manufacturing Engineering**

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	K2ZIP_LS_W01	C1	Lec1, Lec2, Lec3, Lec4, Lec5, Lec6, Lec7, Lec8	N1, N2, N5
PEK_U01, PEK_U02, PEK_U03	K2ZIP_LS_U02	C1, C2	Pr1, Pr2, Pr3, Pr4, Pr5, Pr6, Pr7	N1, N2, N3, N4
PEK_K01, PEK_K02	K2ZIP_LS_K01, K2ZIP_LS_K02	C2	Pr1, Pr2, Pr3, Pr4, Pr5, Pr6, Pr7	N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Logistyka zwrotna oraz gospodarka opakowaniami**

Name in English: **Reverse logistics and packaging management**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Practical Logistics**

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

Kind of subject: **obligatory**

Subject code: **ZPM041114**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30			15	
Number of hours of total student workload (CNPS)	30			60	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	1			2	
including number of ECTS points for practical (P) classes				2	
including number of ECTS points for direct teacher-student contact (BK) classes	0.6			1.4	

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

1. Student has a basic knowledge of management, design and testing processes / systems logistics.
2. Student has a basic knowledge in the field of operations research.
3. Student has a basic knowledge of the spreadsheet, for example. Excel.

### SUBJECT OBJECTIVES

- C1. The aim of the course is to learn the principles of organization and operation logistically integrated waste management system (industrial and municipal), and the returns of products from different segments of the supply chain and increase ecological awareness among students.
- C2. Acquiring the ability to plan and organize material and information flow processes related to handling returns and waste management.
- C3. The acquisition of skills to design packaging management system.
- C4. The acquisition of skills to design logistics systems to support waste management processes.
- C5. Acquisition of the ability to work in a group.

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Understanding of the concept of reverse logistics and green logistics. Knowledge of methods of analysis and identify opportunities to reorient existing waste management system and the principles of creating ecological balances.

PEK\_W02 - Knowledge of the basic laws governing the treatment of waste in Poland.

PEK\_W03 - Knowledge of methods, tools and machinery and equipment used in the process of waste management (collection, transportation, processing).

### II. Relating to skills:

PEK\_U01 - The ability to identify the characteristics and differences between green logistics, reverse logistics and classical logistics. The ability to self-assessment (define their own metrics) the waste management system and the returned products in the area of the company.

PEK\_U02 - Ability to independently design logistics systems supporting the processes of collection, transport, recovery and disposal and re-distribution of products that are returned from different sections of the supply chain and waste.

### III. Relating to social competences:

PEK\_K01 - Ability to work in a group.

PEK\_K02 - Increasing environmental awareness.

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	The history of waste management; Physical materials through the economy. Issue 1. "Pecunia non olet". Issue 2. Waste management at the turn of the nineteenth and twentieth centuries. Issue 3. Physical materials through the economy. Issue 4. Place the waste / phrases. Issue 5. Identification of streams returns in the economy, with the various stages of the supply chain (production, distribution, exhibition). Issue 6. Motivators implementing solutions related to handling streams of returns in the area of the supply chain.	2
Lec2	The scale of the problems of waste in Poland and in the world; Characteristics of quality and classification of waste; The impact of differences in applied technologies for development (collection, disposal, recovery and re-distribution). Issue 1. The scale of the problems of waste in Poland. Issue 2. The scale of the problems of waste in the world. Issue 3. Characteristics of waste. Issue 4. The classification of waste (municipal waste, biodegradable waste, inert waste, hazardous waste) - Waste Catalogue.	2



Lec3	<p>Legal regulations related to waste management in Poland and their impact on the organization of logistics systems supporting the process of waste management.</p> <p>Issue 1. Overview of the basic force in Poland legislation relating to waste management:</p> <ul style="list-style-type: none"> <li>- The Environmental Protection Law;</li> <li>- Waste Act;</li> <li>- Act on maintaining cleanliness and order in municipalities;</li> <li>- Act on packaging and packaging waste;</li> <li>- Act on waste electrical and electronic equipment;</li> <li>- Act on ELVs;</li> <li>- Ordinance of the Minister of the Environment.</li> </ul>	2
Lec4	<p>The structure, tasks and technologies used in logistically integrated waste management system.</p> <p>Issue 1. Structure of logistically integrated waste management system.</p> <p>Issue 2. Participants in the waste management system (Marshal offices, municipalities, entrepreneurs, residents of municipalities, organizations recovery etc.).</p> <p>Issue 3. The tasks of the system.</p> <p>Issue 4. Actions occurring in the system.</p> <p>Issue 5. The technologies used.</p>	2
Lec5	<p>Waste Management document workflow and penalties for failing obligations under the relevant laws and regulations.</p> <p>Issue 1. Reports AXIS-OP1, OPAK1, OPAK2, OPAK3.</p> <p>Issue 2. waste transfer card.</p> <p>Issue 3. Documents confirming recycling and recovery, and more.</p> <p>Issue 4. The resulting legislative reporting deadlines, responsibilities, documents confirming the eligibility of entrants waste management system - a permit for transportation, storage of waste.</p> <p>Issue 5. The product fee, recycling and deposit.</p> <p>Issue 6. Fees for use of the environment.</p> <p>Issue 7. Penalties for failure to comply with reporting obligations and penalties for lack of timely fulfillment of obligations.</p>	2
Lec6	<p>Waste Collection, flow of returns: methods of planning, execution and control of the process of collection and technical measures used to collect, transport and handling of waste.</p> <p>Issue 1. Planning methods of collection.</p> <p>Issue 2. Types of containers used for the selective collection of waste.</p> <p>Issue 3. Determining the collection.</p> <p>Issue 4. Methods of forecasting the amount of waste.</p> <p>Issue 5. planning vehicle routes.</p> <p>Issue 6. Types and characteristics of the funds used for the transport and handling of waste (trucking, rail, inland waterways, sea).</p> <p>Issue 7. Packaging logistics systems used in phrases such as. Transport waste (waste hedging).</p>	2
Lec7	<p>Waste sorting method.</p> <p>Issue 1. waste sorting technology.</p> <p>Issue 2. Principles of machinery and equipment used in the sorting process.</p> <p>Issue 3. The construction of a typical waste sorting plant, the embodiments of this type of investment in Poland and other countries.</p> <p>Issue 4. Modern technologies of waste sorting.</p>	2

Lec8	Methods of waste recovery / reimbursement (non-waste products - excess inventory). Issue 1. Types and methods of recovery of waste. Issue 2. Technical measures used for the recovery of waste (machinery and equipment for crushing, separation, lines, energy recovery methods, etc.).	2
Lec9	The methods of disposal. Issue 1. Characteristics of the methods of disposal of particular types of waste. Issue 2. Characteristics machinery and equipment and other technical means used in the process of waste disposal.	2
Lec10	Structural model of the company performing recovery operations. Issue 1. Structural diagram of the company. Issue 2. Activities logistics in the field of recovery operations.	2
Lec11	LCA in logistic systems of waste management. Issue 1. Introduction. Issue 2. Examples of LCA. Issue 3. Applications of LCA	2
Lec12	Design of waste recovery-oriented or effective their disposal. Issue 1. The initial assumptions design methodology. Issue 2. Conditions design for manufacturing phase. Issue 3. Determinants design for the exploitation phase. Issue 4. Design Considerations for the decommissioning phase. Issue 5. The use of innovative materials and methods to connect components.	2
Lec13	Reusable packaging and warehouse management workflow. Issue 1. Reusable packaging (design, implementation and management of circulation of reusable packaging). Issue 2. A warehouse packaging (types of documents of their destiny and the use). Issue 3. Document Flow warehouse management. Issue 4. Designing manual warehouse management.	2
Lec14	Product labeling and packaging ecological characters. Zag. 1. Types of signs. Zag. 2. The list of examples of signs of obligatory and voluntary markings. Zag. 3. Rules marking of packages and products with the ecology.	2
Lec15	final exam	2
		Total hours: 30
Form of classes – Project		Number of hours
Proj1	Case study: project logistics system supporting the management of plastic waste for companies engaged in plastics processing. 1/2 issues: a) Identification of waste; b) Estimating quantities of waste; c) Development of a model of material flow in the enterprise.	2
Proj2	Case study: project logistics system supporting the management of plastic waste for companies engaged in plastics processing. 2/2 issues: a) the selection of methods and tools used in the process of recovery of plastics; b) the choice of methods and tools for managing product of recovery process.	2

Proj3	Case study: project logistics system to support management of municipal waste. 1/4 issues: a) The organization of selective collection of municipal waste in a way that ensures easy access for all residents of the municipality; b) Methods of sorted waste collection from residents;	2
Proj4	Case study: project logistics system to support management of municipal waste. 2/4 issues: a) Choosing a location segregation of waste, the location of containers for selective collection, or place them directly on citizens (segregation "at source"); b) Methods of assessing the quality of segregation pursued by the citizens; c) the factors motivating residents to separate waste.	2
Proj5	Case study: project of logistics system to support management of municipal waste. 3/4 issues: a) Evaluation of a company dealing with waste reception; b) The receiving frequency of particular types of waste.	2
Proj6	Case study: project logistics system to support management of municipal waste. 4/4 issues: a) The selection of containers for waste collection; b) Place the highest concentration of waste; c) Vehicles and equipment used in the process of collecting, transporting, sorting and processing of waste.	2
Proj7	Reusable packaging design and development of warehouse management instructions for reusable packaging.	2
Proj8	Completion of the course - presentation of projects.	1
		Total hours: 15

#### TEACHING TOOLS USED

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

#### 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	Final test
F2	PEK_W02	Final test
F3	PEK_W03	Final test

$$P = 0,3 \cdot F1 + 0,3 \cdot F2 + 0,4 \cdot F3$$

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	Rating oral replies to the questions raised during the semester and during the presentation of projects
F2	PEK_U02	Evaluation of prepared projects
F3	PEK_K01, PEK_K02	Evaluation of the work in the classroom during the implementation of individual case studies

$$P = 0,2 \cdot F1 + 0,7 \cdot F2 + 0,1 \cdot F3$$

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. Korzeń Z.: Ekologistyka, ILiM, Poznań 2001
2. Bendkowski J. i inni: Logistyka odpadów. t1, Wyd. Politechniki Śląskiej, Gliwice 2002
3. Bendkowski J. i inni: Logistyka odpadów. t2, Wyd. Politechniki Śląskiej, Gliwice 2004
4. Dekker R., Fleischmann M., Inderfurth K., van Wassenhove L. N., Reverse Logistics: Quantitative Models for Closed-Loop Supply Chains, Springer 2010
5. Szoltysek J. Logistyka zwrotna, ILiM, Poznań

SECONDARY LITERATURE

1. Biedugnis S. i inni: Optymalizacja gospodarki odpadami. PWN, Warszawa 1992
2. Bilitewski B. i inni: Podręcznik gospodarki odpadami, Seidel i Przywecki, Warszawa 2003
3. Dembińska-Cyran I., Gubała M.: Podstawy zarządzania transportem w przykładach, ILiM, Poznań 2005
4. Ekologiczna ocena cyklu życia LCA, IGSMiE PAN, Kraków 2001
5. Korzeniowski A. i inni: Ekologistyka zużytych opakowań, ILiM, Poznań 1999
6. Logistyka odzysku. Kwartalnik
6. Merkiż-Guranowska A.: Aspekty rozwoju recyklingu w Polsce, Wyd Instytutu Technologii Eksploatacji, Poznań-Radom 2005
7. Osiński J., Żach P.: Wybrane zagadnienia recyklingu samochodów, WKŁ
8. Rosik-Dulewska C.: Podstawy gospodarki odpadami. PWN, Warszawa 2005
9. Recykling. Miesięcznik

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Reverse logistics and packaging management**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_LS_W01, K2ZIP_LS_W04	C1	Wy1 - Wy15	N1, N2, N4
PEK_U01	K2ZIP_LS_U02	C2, C3, C4	Pr1 - Pr7	N2, N3, N4, N5
PEK_U02	K2ZIP_LS_U03, K2ZIP_LS_U05	C2, C3, C4	Pr1 - Pr7	N2, N3, N4, N5
PEK_K01	K2ZIP_LS_K01, K2ZIP_LS_K02	C5	Pr1 - Pr7	N2, N3, N5
PEK_K02	K2ZIP_K02	C1	Pr1 - Pr7	N2, N3, N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Seminarium dyplomowe**

Name in English: **Diploma seminar**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Practical Logistics**

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

Kind of subject: **obligatory**

Subject code: **ZPM041115**

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)					30
Form of crediting					Crediting with grade
Group of courses					
Number of ECTS points					1
including number of ECTS points for practical (P) classes					1
including number of ECTS points for direct teacher-student contact (BK) classes					0.7

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

**I. Relating to knowledge:**

**II. Relating to skills:**

**III. Relating to social competences:**

PROGRAMME CONTENT

Form of classes – Seminar		Number of hours
Sem1		2
Sem2		2
Sem3		2
Sem4		2
Sem5		2
Sem6		2
Sem7		2
Sem8		2
Sem9		2
Sem10		2
Sem11		2
Sem12		2
Sem13		2
Sem14		2
Sem15		2
		Total hours: 30

TEACHING TOOLS USED
N1. problem discussion N2. multimedia presentation

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Seminar)		
Evaluation (F – forming (during semester), P – concluding (at semester end))	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_K01	
F2	PEK_U01, PEK_U02	
P = 0,5 F1 + 0,5 F2		

PRIMARY AND SECONDARY LITERATURE
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PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Diploma seminar**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_U11	C1		N1
PEK_U01	K2ZIP_U11	C1		N1
PEK_U02	K2ZIP_U11	C2, C3		N2
PEK_K01	K2ZIP_K05, K2ZIP_LS_K03	C3		N1

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Logistyka miejska**

Name in English: **City Logistics**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Practical Logistics**

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

Kind of subject: **optional**

Subject code: **ZPM041120**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15				15
Number of hours of total student workload (CNPS)	30				30
Form of crediting	Crediting with grade				Crediting with grade
Group of courses					
Number of ECTS points	1				1
including number of ECTS points for practical (P) classes					1
including number of ECTS points for direct teacher-student contact (BK) classes	0.6				0.7

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

1. Fundamentals of logistics
2. Logistic supply chains
3. Technology of transport of goods and warehousing

### SUBJECT OBJECTIVES

- C1. The acquisition of knowledge about rationalization of transport people and goods in the territory of cities, through shown implemented examples of coordination of the transport Presentation of the city transport policy as a main way of development.
- C2. Get to know the in the area of the fundamentals of organizations of the goods transport on examples of project ISODLE, SMILE, selection modes of the transport for goods and lad units, integration of goods transport. Fundamentals of the organization of passenger transport. Creation of demand for public transport. Basics of selection for transport of goods. Methods of integration of different modes of public transport.
- C3. Understanding the issues of city supply for technical media, eco-logistics. Fundamentals of strategics management of city.

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - It has an fundamental knowledge of analysis, assessment and design of processes of city logistics

### II. Relating to skills:

PEK\_U01 - Can use in complex mining planning of the goods flows inside the city territory

### III. Relating to social competences:

PEK\_K01 - Able to interact and work in a group, taking there different roles of organization corresponding to the functions in production and service companies.

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Backgrounds of the City logistic. Place of city logistics in management policy of city.	2
Lec2	Tolls of city logistic. Methods of cooperation the city government and society. Moderation of infrastructure and streams of peoples and goods	2
Lec3	City transport policy, Systems of passenger transports.	2
Lec4	Selection of technical modes for transport of passengers and hoods on city	2
Lec5	Needs and purposes for built the city logistic centres, selection of technical load units, telematics in city transport	2
Lec6	Supply the city in technical modes, Ecologicistic in city.	2
Lec7	Tackling and removes of the threats	2
Lec8	oncluding	1
		Total hours: 15
Form of classes – Seminar		Number of hours
Sem1	City transport policy, case studies.	2
Sem2	Passenger transport, costs and availability, case studies	2
Sem3	Goods transport in city, city logistic centres, case study	2
Sem4	Delivery of goods in city centre, field research 1	4
Sem5	Delivery of goods in city centre, field research 2, results	2
Sem6	Threats in city, study of cases	2
Sem7	Summary	1
		Total hours: 15

## TEACHING TOOLS USED

- N1. case study
- N2. self study - self studies and preparation for examination
- N3. traditional lecture with the use of transparencies and slides

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	concluding
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Seminar)

Evaluation (F – forming (during semester), P – concluding (at semester end))	Educational effect number	Way of evaluating educational effect achievement
F1	PEK-U01, PEK-K01	written work
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. Abt S.: Logistyka w teorii i praktyce, Akademia Ekonomiczna w Poznaniu, 2001;
2. Dudek J.(red): Centra logistyczne w Polsce, materiały I Ogólnopolskiej Konferencji, Wrocław 20.04.2001, CL Consulting i Logistyka, Oficyna Wydawnicza „Nasz Dom i ogród”, Wrocław 2001-2003;
3. Gołemska E.(red): Kompendium wiedzy o logistyce, PWN, Warszawa-Poznań 1999;
4. J. Grajner, S.Kwaśniewski, T.Nowakowski: Miejsce transportu kolejowego w łańcuchach i sieciach logistycznych, Ofic. Wyd. PWr, Wrocław 2002
5. J.Marcinkowski: Systemy transportowe Środki transportu, Ofic Wyd. PWr, Wrocław 1988;
6. M.Młyńczak (red): Analiza ryzyka w transporcie towarów i przemyśle, Ofic. Wyd. PWr.Wrocław 1997;
7. Z.Korzeń: Logistyczne systemy transportu bliskiego i magazynowania, ILiM, Poznań 1998r;
8. Z.Korzeń (red): Logistyka w transporcie towarów, Ofic. Wyd. PWr,Wrocław 1998;

SECONDARY LITERATURE

Magazines: Logistyka, Transport and Logistics,

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**City Logistics**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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,	K2ZIP_LS_W01	C1.	Lect 1 - Lect 7	N1-N3
PEK_U01,	K2ZIP_LS_U04, K2ZIP_LS_U09	C2	Sem-1 - Sem-7	N1-N3
PEK_K01	K2ZIP_K03, K2ZIP_K05	C3	Lect.1-Lect 7, Sem-1 - Sem-7	N1- N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Logistyka niekonwencjonalna**

Name in English: **Unconventional logistics**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Practical Logistics**

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

Kind of subject: **optional**

Subject code: **ZPM041121**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15			15	
Number of hours of total student workload (CNPS)	30			30	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	1			1	
including number of ECTS points for practical (P) classes				1	
including number of ECTS points for direct teacher-student contact (BK) classes	0.6			0.7	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

**I. Relating to knowledge:**

**II. Relating to skills:**

**III. Relating to social competences:**

PROGRAMME CONTENT		
Form of classes – Lecture		Number of hours
Lec1		2
Lec2		2
Lec3		2
Lec4		2
Lec5		2
Lec6		2
Lec7		2
Lec8		1
		Total hours: 15
Form of classes – Project		Number of hours
Proj1		2
Proj2		2
Proj3		2
Proj4		2
Proj5		2
Proj6		2
Proj7		2
Proj8		1
		Total hours: 15

TEACHING TOOLS USED	
N1. problem lecture	
N2. self study - preparation for project class	

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_K01, PEK_K02	
P = F1*100%		

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_K01, PEK_K02	
P = F1* 100%		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Unconventional logistics**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_W11	C1, C2, C3		N1
PEK_U01	K2ZIP_LS_U07	C1, C2, C3		N2
PEK_K01, PEK_K02	K2ZIP_K01, K2ZIP_LS_K03	C1, C2, C3		N1, N2

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Zarządzanie małą firmą**

Name in English: **Small Enterprise Management**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Practical Logistics**

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

Kind of subject: **optional**

Subject code: **ZPM041122**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15			15	
Number of hours of total student workload (CNPS)	30			30	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	1			1	
including number of ECTS points for practical (P) classes				1	
including number of ECTS points for direct teacher-student contact (BK) classes	0.6			0.7	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

**I. Relating to knowledge:**

**II. Relating to skills:**

**III. Relating to social competences:**



PROGRAMME CONTENT		
Form of classes – Lecture		Number of hours
Lec1		2
Lec2		2
Lec3		2
Lec4		2
Lec5		2
Lec6		2
Lec7		2
Lec8		1
		Total hours: 15
Form of classes – Project		Number of hours
Proj1		2
Proj2		2
Proj3		2
Proj4		2
Proj5		2
Proj6		2
Proj7		2
Proj8		1
		Total hours: 15

TEACHING TOOLS USED
N1. multimedia presentation N2. tutorials N3. self study - preparation for project class

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_K01	
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_U01, PEK_U02	
F2	PEK_K01	
P = (F1+F2)/2		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Small Enterprise Management**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_LS_W07	C1-C3		N1,N2
PEK-U02, PEK_K01	K2ZIP_LS_K01, K2ZIP_LS_K02, K2ZIP_LS_K03	C1-C3		N2, N3
PEK_U	K2ZIP_LS_U11	C1-C3		

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **PRACA DYPLOMOWA I, II**

Name in English: **MASTER THESIS**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Practical Logistics**

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

Kind of subject: **obligatory**

Subject code: **ZPM041151, ZPM041152**

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)				600	
Form of crediting				Crediting with grade	
Group of courses					
Number of ECTS points				20	
including number of ECTS points for practical (P) classes				20	
including number of ECTS points for direct teacher-student contact (BK) classes				20.0	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

**I. Relating to knowledge:**

**II. Relating to skills:**

**III. Relating to social competences:**

PROGRAMME CONTENT

TEACHING TOOLS USED

- N1. case study
- N2. tutorials
- N3. self study - self studies and preparation for examination

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**MASTER THESIS**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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_U1, PEK_U2, PEK_U3	K2ZIP_U14	C1, C2, C3		N1, N2, N3
PEK_K1, PEK_K2, PEK_K3	K2ZIP_K04	C1, C2, C3		N1, N2, N3

SUBJECT SUPERVISOR

Prof. dr hab. inż. Tomasz Nowakowski tel.: 71 320-35-11 email: Tomasz.Nowakowski@pwr.edu.pl

Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Badania operacyjne**

Name in English: **Operations research**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Manufacturing Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041201**

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)	90				
Form of crediting	Crediting with grade				
Group of courses					
Number of ECTS points	3				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	1.8				

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

1. Knowledge of the issues presented in the courses "Mathematical Analysis", "Algebra and Analytic Geometry" and "Engineering Statistics".

### SUBJECT OBJECTIVES

C1. Students should obtain basic knowledge from the linear programming and the game theory, taking into account the aspects of their application.

C2. Participants learn to formulate optimization problems in the field of management, transport services market, location of distribution and construction, technology, and systems designing. They also acquire the ability to formulate optimization problems from queuing theory.

C3. Participants obtain and consolidate social skills including emotional intelligence involving the ability to work in a group of students to solve problems effectively with regard to accountability, integrity and fairness in the proceedings

SUBJECT EDUCATIONAL EFFECTS

**I. Relating to knowledge:**

PEK\_W01 - Student has a basic knowledge of linear programming methods and methods supporting optimal decision taking. He knows the basics of linear programming, the simplex algorithm, can construct the dual model, knows methods of sensitivity analysis of the optimal solution. He has knowledge of basic programming and discrete algorithms, knows the basic algorithms for solving balanced transportation problem, the basics of formulating and solving problems related to minimizing empty runs, knows the basics of graph theory and can apply them to solve the issues related to project management. He knows the basic concepts of the game theory.

**II. Relating to skills:**

**III. Relating to social competences:**

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Operations research as a tool to support decision-making processes - classification decision-making processes. Methods of decision making under conditions of certainty. Linear programming (PL) - linear model of decision-making, decisions acceptable and optimal. Graphical methods of PL problem solving. Training the discussed material.	2
Lec2	Linear programming models. Formulation and solution of problems PL - interpretation of the results. Simplex algorithm. Training the discussed material.	2
Lec3	Duality in linear programming. Matrix calculus in solving tasks of PL. The dual problem, its measurement and interpretation. Sensitivity analysis of the optimum solution. Changes in the parameters of the objective function and the free terms of constraints. Addition or removing decision variables. Comprehensive analysis of the optimal solution.	2
Lec4	Integer Linear Programming (discrete). The method of shutoff surfaces.	2
Lec5	Classical transportation models and algorithms. Transportation model with the criterion of time. Transportation model (unbalanced, with limited bandwidth routes). The problem of localization of production.	2
Lec6	Examples of problems, which may be reduced to the transportation problem (issue of optimal allocation). The tasks of transport, production and transport and warehousing. Minimizing empty runs. Blocking the route. The multi-stage transportation problem.	2
Lec7	Introduction to graph theory. Project management (network programming). The maximum flow in a network. Ford-Fulkerson algorithm. Decision trees. Minimum spanning tree. The shortest routes in the graph.	2
Lec8	Network Models - deterministic (CPM, PERT) and stochastic (GERT). Time and cost analysis. Gantt charts. Resource optimization in network. Salesman Problem. Little's algorithm. The knapsack problem. The production and inventory models.	2
Lec9	Multi-criteria optimization. Selection of nonlinear decision models solvable with PL methods.	2

Lec10	Introduction and examples of games (multiplayer, double zero-sum, multi-stage, random). Basic concepts (pure strategy, mixed, payment, the value of the game).	2
Lec11	Matrix games - mixed strategies, expected value criterion, graphical method for solving games $2 \times n$ . John von Neumann's theorem on the existence of solutions for each game matrix. Training the discussed material.	2
Lec12	Examples of the use of mixed strategies: fishing in Jamaica, playing "the guerrillas and the police." Tree - a character-developed game. Solving game with method "pruning the tree" (backwards induction).	2
Lec13	Games against nature. Criteria for finding the optimal decision: Laplace, the Bayesian Hurwicz and Savage's.	2
Lec14	Double games with non-zero sum: Nash equilibrium, Pareto optimality, safe and contsafe strategies. Nash arbitration scheme and cooperative solutions. Employer-employee negotiations.	2
Lec15	Final test.	2
		Total hours: 30

TEACHING TOOLS USED

- N1. traditional lecture with the use of transparencies and slides  
N2. problem discussion

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	test, oral answer
P = F1		

PRIMARY AND SECONDARY LITERATURE

#### PRIMARY LITERATURE

[1] Ignasiak E. (red.): Badania operacyjne. Warszawa 2001, PWE[2] Kukuła K. (red.): Badania operacyjne w przykładach i zadaniach. Warszawa 2002, PWN[3] Trzaskalik T.: Wprowadzenie do badań operacyjnych z komputerem. Warszawa 2008, PWE[4] Straffin P.: Teoria gier, 2001, Scholar[5] Malawski M., Wieczorek A., Sosnowska H. (2004): Konkurencjai kooperacja. Teoria gier w ekonomii i naukach społecznych, 2004, PWN.

#### SECONDARY LITERATURE

[1] Stadnicki J.: Teoria i praktyka rozwiązywania zadań optymalizacji z przykładami zastosowań technicznych. Warszawa 2006, WNT[2] Szapiro T. (red.): Decyzje menadżerskie z Excelem. Warszawa 2000, PWE[3] Guzik B.: Ekonometria i badania operacyjne. Wydawnictwo AE Poznań, Poznań 1999[4] Krawczyk S.: Badania operacyjne dla menadżerów. Wydawnictwo AE Wrocław 1996[5] Lipiec-Zajchowska M. (red.): Wspomaganie procesów decyzyjnych. Tom III. Badania operacyjne. Wydawnictwo C.H. Beck, Warszawa 2003[6] Anholcer M., Gaspras H., Owczarkowski A.: Przykłady i zadania z badań operacyjnych i ekonometrii. Wydawnictwo AE Poznań, Poznań 2003[7]. Watson J.: Strategia: Wprowadzenie do teorii gier, 2005, Norton, New York.[8] Gibbons R.: Game Theory for Applied Economists, 1992 Princeton U.P.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Operations research**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_W01, K2ZIP_W02	C1, C2, C3	Lec1-Lec15	N1, N2, N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Badania operacyjne**

Name in English: **Operations research**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Quality Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041201**

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)	90				
Form of crediting	Crediting with grade				
Group of courses					
Number of ECTS points	3				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	1.8				

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

1. Knowledge of the issues presented in the courses "Mathematical Analysis", "Algebra and Analytic Geometry" and "Engineering Statistics".

### SUBJECT OBJECTIVES

C1. Students should obtain basic knowledge from the linear programming and the game theory, taking into account the aspects of their application.

C2. Participants learn to formulate optimization problems in the field of management, transport services market, location of distribution and construction, technology, and systems designing. They also acquire the ability to formulate optimization problems from queuing theory.

C3. Participants obtain and consolidate social skills including emotional intelligence involving the ability to work in a group of students to solve problems effectively with regard to accountability, integrity and fairness in the proceedings

SUBJECT EDUCATIONAL EFFECTS

**I. Relating to knowledge:**

PEK\_W01 - Student has a basic knowledge of linear programming methods and methods supporting optimal decision taking. He knows the basics of linear programming, the simplex algorithm, can construct the dual model, knows methods of sensitivity analysis of the optimal solution. He has knowledge of basic programming and discrete algorithms, knows the basic algorithms for solving balanced transportation problem, the basics of formulating and solving problems related to minimizing empty runs, knows the basics of graph theory and can apply them to solve the issues related to project management. He knows the basic concepts of the game theory.

**II. Relating to skills:**

**III. Relating to social competences:**

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Operations research as a tool to support decision-making processes - classification decision-making processes. Methods of decision making under conditions of certainty. Linear programming (PL) - linear model of decision-making, decisions acceptable and optimal. Graphical methods of PL problem solving. Training the discussed material.	2
Lec2	Linear programming models. Formulation and solution of problems PL - interpretation of the results. Simplex algorithm. Training the discussed material.	2
Lec3	Duality in linear programming. Matrix calculus in solving tasks of PL. The dual problem, its measurement and interpretation. Sensitivity analysis of the optimum solution. Changes in the parameters of the objective function and the free terms of constraints. Addition or removing decision variables. Comprehensive analysis of the optimal solution.	2
Lec4	Integer Linear Programming (discrete). The method of shutoff surfaces.	2
Lec5	Classical transportation models and algorithms. Transportation model with the criterion of time. Transportation model (unbalanced, with limited bandwidth routes). The problem of localization of production.	2
Lec6	Examples of problems, which may be reduced to the transportation problem (issue of optimal allocation). The tasks of transport, production and transport and warehousing. Minimizing empty runs. Blocking the route. The multi-stage transportation problem.	2
Lec7	Introduction to graph theory. Project management (network programming). The maximum flow in a network. Ford-Fulkerson algorithm. Decision trees. Minimum spanning tree. The shortest routes in the graph.	2
Lec8	Network Models - deterministic (CPM, PERT) and stochastic (GERT). Time and cost analysis. Gantt charts. Resource optimization in network. Salesman Problem. Little's algorithm. The knapsack problem. The production and inventory models.	2
Lec9	Multi-criteria optimization. Selection of nonlinear decision models solvable with PL methods.	2

Lec10	Introduction and examples of games (multiplayer, double zero-sum, multi-stage, random). Basic concepts (pure strategy, mixed, payment, the value of the game).	2
Lec11	Matrix games - mixed strategies, expected value criterion, graphical method for solving games $2 \times n$ . John von Neumann's theorem on the existence of solutions for each game matrix. Training the discussed material.	2
Lec12	Examples of the use of mixed strategies: fishing in Jamaica, playing "the guerrillas and the police." Tree - a character-developed game. Solving game with method "pruning the tree" (backwards induction).	2
Lec13	Games against nature. Criteria for finding the optimal decision: Laplace, the Bayesian Hurwicz and Savage's.	2
Lec14	Double games with non-zero sum: Nash equilibrium, Pareto optimality, safe and contsafe strategies. Nash arbitration scheme and cooperative solutions. Employer-employee negotiations.	2
Lec15	Final test.	2
		Total hours: 30

TEACHING TOOLS USED

- N1. traditional lecture with the use of transparencies and slides  
N2. problem discussion

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	test, oral answer
P = kolokwium		

PRIMARY AND SECONDARY LITERATURE

#### PRIMARY LITERATURE

[1] Ignasiak E. (red.): Badania operacyjne. Warszawa 2001, PWE[2] Kukuła K. (red.): Badania operacyjne w przykładach i zadaniach. Warszawa 2002, PWN[3] Trzaskalik T.: Wprowadzenie do badań operacyjnych z komputerem. Warszawa 2008, PWE[4] Straffin P.: Teoria gier, 2001, Scholar[5] Malawski M., Wieczorek A., Sosnowska H. (2004): Konkurencjai kooperacja. Teoria gier w ekonomii i naukach społecznych, 2004, PWN.

#### SECONDARY LITERATURE

[1] Stadnicki J.: Teoria i praktyka rozwiązywania zadań optymalizacji z przykładami zastosowań technicznych. Warszawa 2006, WNT[2] Szapiro T. (red.): Decyzje menadżerskie z Excelem. Warszawa 2000, PWE[3] Guzik B.: Ekonometria i badania operacyjne. Wydawnictwo AE Poznań, Poznań 1999[4] Krawczyk S.: Badania operacyjne dla menadżerów. Wydawnictwo AE Wrocław 1996[5] Lipiec-Zajchowska M. (red.): Wspomaganie procesów decyzyjnych. Tom III. Badania operacyjne. Wydawnictwo C.H. Beck, Warszawa 2003[6] Anholcer M., Gaspras H., Owczarkowski A.: Przykłady i zadania z badań operacyjnych i ekonometrii. Wydawnictwo AE Poznań, Poznań 2003[7]. Watson J.: Strategia: Wprowadzenie do teorii gier, 2005, Norton, New York.[8] Gibbons R.: Game Theory for Applied Economists, 1992 Princeton U.P.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Operations research**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_W01, K2ZIP_W02	C1, C2, C3	Lec1-Lec15	N1, N2

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Metody i techniki eksperymentu**

Name in English: **Methods and techniques of experiments**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Quality Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041202**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30			15	
Number of hours of total student workload (CNPS)	60			60	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	2			2	
including number of ECTS points for practical (P) classes				2	
including number of ECTS points for direct teacher-student contact (BK) classes	1.2			1.4	

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

1. Basic knowledge of statistics, mathematical analysis and linear algebra

### SUBJECT OBJECTIVES

- C1. Explain the purpose of carrying out experiments
- C2. Explain the methods and techniques to carry out the experiment
- C3. Explain the types and purposes of tools to carry out the experiment

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Able to define the purpose and effect of the proposed experiment

PEK\_W02 - Able to propose and define a plan of the experiment

PEK\_W03 - Knows the concept and objectives of the experiment

### II. Relating to skills:

PEK\_U01 - Can collect data for the experiment

PEK\_U02 - Can process the data of the experiment

PEK\_U03 - Able to design an experiment

### III. Relating to social competences:

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction, concept experiment	2
Lec2	The differences between the method and technique	2
Lec3	Basic experiment Part 1	2
Lec4	Basic experiment Part 2	2
Lec5	Measurement	2
Lec6	Statistical tools	2
Lec7	Quality Tools	2
Lec8	Optimization Tools	2
Lec9	Factorial / multifactorial experiment	2
Lec10	DoE	2
Lec11	Methods for optimization of technological processes Part 1	2
Lec12	Methods for optimization of technological processes Part 2	2
Lec13	Case Study Part 1	2
Lec14	Case Study Part 2	2
Lec15	Summary, examination	2
		Total hours: 30
Form of classes – Project		Number of hours
Proj1	Introduction, health and safety regulations	2
Proj2	Discussion of proposed projects	2
Proj3	Choice of the experiment	2
Proj4	Data processing Part 1	2
Proj5	Data processing Part 2	2
Proj6	Verification and Optimization	2
Proj7	Summary, projects checking	2

Proj8	Examination	1
		Total hours: 15

TEACHING TOOLS USED
N1. traditional lecture with the use of transparencies and slides N2. informative lecture N3. case study N4. self study - preparation for project class

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	test
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_U01, PEK_U02, PEK_U02	project / test
P = F1		

PRIMARY AND SECONDARY LITERATURE
<u>PRIMARY LITERATURE</u> Ewaryst Rafajłowicz "Optimization of the experiment with applications in monitoring the quality of production" Publishing Wrocław University of Technology Mieczysław Korzyński "Methodology of the experiment" WNT
<u>SECONDARY LITERATURE</u>

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Methods and techniques of experiments**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_ZJ_W08	C1, C2, C3	Lec1-Lec15	N1, N2
PEK_U01, PEK_U02, PEK_U02	K2ZIP_ZJ_U12	C1, C2, C3	Proj1-Proj7	N3, N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Metody i techniki eksperymentu**

Name in English: **Methods and techniques of experiments**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Manufacturing Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041202**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30			15	
Number of hours of total student workload (CNPS)	60			60	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	2			2	
including number of ECTS points for practical (P) classes				2	
including number of ECTS points for direct teacher-student contact (BK) classes	1.2			1.4	

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

1. Basic knowledge of statistics, mathematical analysis and linear algebra

### SUBJECT OBJECTIVES

- C1. Explain the purpose of carrying out experiments
- C2. Explain the methods and techniques to carry out the experiment
- C3. Explain the types and purposes of tools to carry out the experiment

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Able to define the purpose and effect of the proposed experiment

PEK\_W02 - Able to propose and define a plan of the experiment

PEK\_W03 - Knows the concept and objectives of the experiment

### II. Relating to skills:

PEK\_U01 - Can collect data for the experiment

PEK\_U02 - Can process the data of the experiment

PEK\_U03 - Able to design an experiment

### III. Relating to social competences:

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction, concept experiment	2
Lec2	The differences between the method and technique	2
Lec3	Basic experiment Part 1	2
Lec4	Basic experiment Part 2	2
Lec5	Measurement	2
Lec6	Statistical tools	2
Lec7	Quality Tools	2
Lec8	Optimization Tools	2
Lec9	Factorial / multifactorial experiment	2
Lec10	DoE	2
Lec11	Methods for optimization of technological processes Part 1	2
Lec12	Methods for optimization of technological processes Part 2	2
Lec13	Case Study Part 1	2
Lec14	Case Study Part 2	2
Lec15	Summary, examination	2
		Total hours: 30
Form of classes – Project		Number of hours
Proj1	Introduction, health and safety regulations	2
Proj2	Discussion of proposed projects	2
Proj3	Choice of the experiment	2
Proj4	Data processing Part 1	2
Proj5	Data processing Part 2	2
Proj6	Verification and Optimization	2
Proj7	Summary, projects checking	2

Proj8	Examination	1
		Total hours: 15

TEACHING TOOLS USED		
N1. traditional lecture with the use of transparencies and slides		
N2. informative lecture		
N3. case study		
N4. self study - preparation for project class		

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	test
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_U01, PEK_U02, PEK_U03	project / test
P = F1		

PRIMARY AND SECONDARY LITERATURE		
<u>PRIMARY LITERATURE</u>		
Ewaryst Rafajłowicz "Optimization of the experiment with applications in monitoring the quality of production" Publishing Wrocław University of Technology		
Mieczysław Korzyński "Methodology of the experiment" WNT		
<u>SECONDARY LITERATURE</u>		

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Methods and techniques of experiments**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_OP_W08	C1, C2, C3	Lec1-Lec15	N1, N2, N3
PEK_U01, PEK_U02, PEK_U03	K2ZIP_OP_U06	C1, C2, C3	Proj1-Proj7	N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

### SUBJECT CARD

Name in Polish: **Metody kształtowania wybranych cech produktów**

Name in English: **Methods for forming of the selected products features**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Manufacturing Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041203**

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					
including number of ECTS points for direct teacher-student contact (BK) classes	1.2				

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

1. Student has a basic knowledge of manufacturing technologies, machining methods, the basic properties of the materials
2. Student has basic skills in the selection of materials and manufacturing processes
3. Student has abilities of analyzing and synthesis of information

### SUBJECT OBJECTIVES

- C1. Acquiring knowledge about phenomena affecting the using wear of products. Learning about the surface engineering methods shaping functional, technological and operational properties of products.
- C2. Acquisition of skills of understanding the links between the characteristics of the material and geometric properties of the surface layers and consumables products. Acquisition of skills for choosing surface engineering methods for forming selected features of the products.
- C3. The acquisition and consolidation of social skills include: team working abilities, responsible, accountable use of engineering knowledge.

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Enumerates and briefly characterises the basic phenomena that affect the using wear of products.

Explains the basic terms of surface engineering.

PEK\_W02 - Characterises basic properties of surface layers and explains their effect on the usable characteristics of the products.

PEK\_W03 - Explains the implementation mechanisms of surface treatment processes. Enumerates and characterises the basic groups of the processes forming of usable characteristics of the surface layers.

### II. Relating to skills:

### III. Relating to social competences:

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction to the course topics. Rules of the course.	2
Lec2	Preview of the external factors (work conditions) influences on the products.	2
Lec3	Introduction to the surface engineering methods.	2
Lec4	Features of the products formed by surface engineering methods.	2
Lec5	Manufacturing processes for modifying of the properties superficial layers of the Fe alloys.	2
Lec6	Manufacturing processes for modifying of the properties superficial layers of the non-ferrous alloys.	2
Lec7	Laser processing methods of the superficial layers.	2
Lec8	Chemical and electro – chemical coating methods.	2
Lec9	Thermal spray coating processes.	2
Lec10	CVD & PVD coating processes.	2
Lec11	Surface engineering methods in the new product development.	2
Lec12	Economical issues of the implementation surface engineering methods.	2
Lec13	Surface engineering methods in manufacturing: case study.	2
Lec14	Surface engineering methods in manufacturing: case study.	2
Lec15	Final test	2
		Total hours: 30

## TEACHING TOOLS USED

- N1. informative lecture
- N2. problem lecture
- N3. tutorials
- N4. case study
- N5. problem discussion

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	colloquium
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

- T.Burakowski, T.Wierzchoń: Inżynieria powierzchni metali, WNT 1995  
 L.A. Dobrzański: Materiały inżynierskie i projektowanie materiałowe. Podstawy nauki o materiałach i metaloznawstwo, WNT, 2006  
 A.Kimpel: Napawanie i natryskiwanie cieplne. Technologie, WNT, Warszawa, 2000  
 M.Blicharski, Inżynieria powierzchni, WNT 2009

SECONDARY LITERATURE

- F.W.Bach, K.Mohwid, A.Laarmann, T.Wenz: Modern Surface Technology, Willey, 2006  
 L.A. Dobrzański: Podstawy kształtowania struktury i własności materiałów metalowych, Wydawnictwo Politechniki Śląskiej, 2007  
 P.Kula Inżynieria warstwy wierzchniej, Wyd. Pol. Łódz. 2000  
 L.A. Dobrzański: Kształtowanie struktury oraz własności materiałów inżynierskich i biomedycznych  
 E.Kannatey-Asibu: Principles of laser material processing, Willey, 2009  
 R.B. Heinmann: Plasma spray coating, Willey 2008  
 M. Cartier: Handbook of surface treatment and coatings, Professional Engineering Publishing 2003  
 Surface engineering for corrosion and wear resistance, Materials Park, OH : ASM International: Institute of Materials, 2001.  
 A guide to surface engineering terminology London : Institute of Materials in association with the IFHT, 1995.  
 Inżynieria Powierzchni, Instytut Mechaniki Precyzyjnej, Warszawa 1996-  
 Surface and Coatings Technology, Elsevier, 2000-  
 Surface Engineering, Maney Publishing, 2003 -

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Methods for forming of the selected products features**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_OP_W10, K2ZIP_W04	C1, C2, C3	Lec1 - Lec14	N1, N2, N3, N4, N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Planowanie technologiczne CAD/CAM**

Name in English: **Technology planning CAD/CAM.**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Manufacturing Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041204**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15			15	
Number of hours of total student workload (CNPS)	60			60	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	2			2	
including number of ECTS points for practical (P) classes				2	
including number of ECTS points for direct teacher-student contact (BK) classes	1.2			1.4	

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

1. Fundamentals of geometric modeling and CAD systems.
2. Fundamentals on technology planning.
3. Basic knowledge about numerically controlled machine tools.

### SUBJECT OBJECTIVES

- C1. Gaining knowledge in the field of technology design for CNC machine tools using CAD/CAM systems.
- C2. Presentation of modern tools supporting manufacturing.
- C3. Discussion of issues related to project management in the field of structural design and technology.
- C4. Discussion of issues of selection, implementation and integration of CAD/CAM systems.

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Knowledge about existing solutions supporting structural design and technology.

PEK\_W02 - Ordered knowledge of technological design in CAM systems.

PEK\_W03 - Knowledge regarding the selection, integration and implementation of CAD/CAM systems in enterprises.

### II. Relating to skills:

PEK\_U01 - Student should be able to analyze parts taking into account that will be manufactured on CNC machine tools. Analysis of the structure manufacturability.

PEK\_U02 - Student should be able to prepare geometric data necessary to carry out project work.

PEK\_U03 - Student should be able to prepare a technological process for CNC machine tools using selected CAD/CAM systems.

### III. Relating to social competences:

PEK\_K01 - Ability to work in a design team.

PEK\_K02 - Ability to critically evaluate the results and their impact on the functioning of the company.

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction to CAD/CAM. A review of available solutions.	2
Lec2	Integration of CAD/CAM systems.	2
Lec3	Project management in an environment of CAD/CAM system. Relationship between documents. Generating the documentation.	2
Lec4	Technological design in CAM systems. The steps and tasks performed.	2
Lec5	Technological design in CAM systems. Functions of CAM.	2
Lec6	Presentation of selected machining strategy.	2
Lec7	Processes verification through computer simulation.	2
Lec8	Final test.	1
		Total hours: 15
Form of classes – Project		Number of hours
Proj1	Presentation of the selected environment of CAD/CAM system.	2
Proj2	Preparation of geometric data. Developing a plan of treatment for the sample.	4
Proj3	Generating tool paths for machining. Machining simulation. Management of the project.	4
Proj4	Generating technical documentation. NC code generation.	2
Proj5	Applying the FBM method to technology design for milled parts.	2
Proj6	Receive and evaluation of projects.	1
		Total hours: 15

### TEACHING TOOLS USED

- N1. traditional lecture with the use of transparencies and slides
- N2. multimedia presentation
- N3. problem discussion
- N4. self study - preparation for project class
- 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_W02, PEK_W03,	final test

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_U01, PEK_U02, PEK_U03	Evaluation of a project

P = F1

### PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Technology planning CAD/CAM.**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_OP_W04	C1, C3, C4	Lec1, Lec2, Lec3, Lec4, Lec5, Lec6, Lec7	N1, N2, N5
PEK_U01, PEK_U02, PEK_U03	K2ZIP_OP_U04, K2ZIP_OP_U05	C2, C3	Proj1, Proj2, Proj3, Proj4, Proj5	N2, N3, N4, N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Utrzymanie ruchu maszyn i urządzeń**

Name in English: **Operation maintenance of machines and devices**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Manufacturing Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041205**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30			15	
Number of hours of total student workload (CNPS)	60			30	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	2			1	
including number of ECTS points for practical (P) classes				1	
including number of ECTS points for direct teacher-student contact (BK) classes	1.2			0.7	

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

1. It has a basic knowledge of the structure and operation of components and assemblies as well as the principles of selection and construction.
2. It has a basic knowledge of basic techniques regarding machines exploitation, reliability and safety.
3. It has a well-established expertise in construction and machine control rules.

### SUBJECT OBJECTIVES

- C1. Getting to know the basic principles of the concept of Total Productive maintenance (TPM).
- C2. Understanding the basic tools of TPM and methods to increase the efficiency of maintenance of the machinery. Understanding the principles of determining indicators of progress in the implementation of TPM methodology.
- C3. Getting to know the basic features and capabilities of computer systems of the CMMS class supporting scheduling service and repair tasks, inventory management and servicing and repair personnel management.

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Knows the range of activities and principles of choice of strategy of maintenance of manufacturing machinery and equipment.

PEK\_W02 - Knows the basic tools and indicators TPM.

PEK\_W03 - Knows the basic features and capabilities of computer systems of the CMMS class supporting scheduling service and repair tasks, inventory management and servicing and repair personnel management.

### II. Relating to skills:

PEK\_U01 - Can use the acquired knowledge to formulate tasks to improve the system of maintenance of manufacturing machinery and equipment.

PEK\_U02 - Is able to determine the indicators covering the progress in the implementation of TPM methodology.

PEK\_U03 - Can use modern IT tools for computerized management of maintenance processes.

### III. Relating to social competences:

PEK\_K01 - Can search and use the recommended literature for the course and independently acquire knowledge.

PEK\_K02 - He can take advantage of modern IT tools.

PEK\_K03 - Understands the need for regular and independent work on the mastery of the course material.

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	The basic issues related to maintenance of manufacturing machinery and equipment: performance requirements, the analysis of cause-and-effect machine failure, the role and importance (benefits) of the organization and planning of maintenance	4
Lec2	History and development of the concept of TPM, characteristics of basic pillars of TPM	2
Lec3	Characteristics of the main tools in the field of TPM - examples of their use	4
Lec4	Maintenance strategies - the idea of a systematic and systemic approach to the problem of maintenance	2
Lec5	Measures and indicators determining the effectiveness of the implementation of the TPM methodology	2
Lec6	IT systems of CMMS class, maintenance management support (requirements and functions of selected systems, the selection criteria of the system)	4
Lec7	Implementation of TPM methodology into industrial practice (role of Maintenance and its organization)	2
Lec8	Examples of solutions for the implementation of the TPM	8
Lec9	Test	2
		Total hours: 30
Form of classes – Project		Number of hours
Proj1	Introduction. Presentation of selected modules of the CMMS	3
Proj2	Spare Parts Management. The part card. Warehouse Management. The structure of the module and generated documents	2

Proj3	Fulfilling orders for maintenance. Generating demand for materials and spare parts	2
Proj4	Management of personell that fulfills maintenance activities. Reports from the workload. Planning service orders. The stages and the necessary data. Building schedules for maintenance execution	4
Proj5	Reporting of orders completion. Cost analysis: planned and actual costs. Reports for maintenance indicators	2
Proj6	Credit	2
		Total hours: 15

TEACHING TOOLS USED	
N1. traditional lecture with the use of transparencies and slides	
N2. self study - preparation for project class	

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	Test
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_U01, PEK_U02, PEK_U03 PEK_K01, PEK_K02, PEK_K03	Project defense
P = F1		

PRIMARY AND SECONDARY LITERATURE	
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#### PRIMARY LITERATURE

Legutko S.: Podstawy eksploatacji maszyn i urządzeń. Wyd. WSiP. Warszawa, 2007.  
Słowiński B.: Inżynieria eksploatacji maszyn. Wyd. Pol. Koszalińskiej. Koszalin, 2011.  
Kaźmierczak J.: Eksploatacja systemów technicznych. Wyd. Pol. Śląskiej. Gliwice, 2000.

#### SECONDARY LITERATURE

Hebda M.: Elementy teorii eksploatacji systemów technicznych. Wyd. MCNEMT. Radom, 1990.  
Żółtowski B.: Podstawy diagnostyki maszyn. Wyd. ATR Bydgoszcz. Bydgoszcz, 1996.  
Honczarenko J.: Elastyczna automatyzacja wytwarzania. Obrabiarki i systemy obróbkowe. WNT Warszawa, 2000.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Operation maintenance of machines and devices**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_OP_W09	C1 - C3	Lec1 - Lec8	N1, N2
PEK_U01, PEK_U02, PEK_U03	K2ZIP_OP_U08	C1 - C3	Pr1 - Pr5	N2
PEK_K01, PEK_K02, PEK_K03	K2ZIP_K02	C1 - C3	Lec1 - Lec8, Pr1 - Pr5	N1, N2

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Utrzymanie ruchu maszyn i urządzeń**

Name in English: **Operation maintenance of machines and devices**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Quality Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041205**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30			15	
Number of hours of total student workload (CNPS)	60			30	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	2			1	
including number of ECTS points for practical (P) classes				1	
including number of ECTS points for direct teacher-student contact (BK) classes	1.2				

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

1. It has a basic knowledge of the structure and operation of components and assemblies as well as the principles of selection and construction.
2. It has a well-established knowledge of basic techniques.
3. It has a well-established expertise in construction and machine control rules.

### SUBJECT OBJECTIVES

- C1. Understanding the basic principles of the concept of Total Productive maintenance (TPM).
- C2. Understanding the basic tools of TPM and methods to increase the efficiency of maintenance of the machinery. Understanding the principles of determining indicators of progress in the implementation of TPM methodology.
- C3. Getting to know principles of determination of factors describing progress in introduction of the TPM method.
- C4. Learning capabilities of computer systems of the CMMS class supporting scheduling service and repair tasks, inventory management and servicing and repair personnel management.

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Knows the range of activities and principles of choice of strategy of maintenance of manufacturing machinery and equipment.

PEK\_W02 - Knows the basic tools and indicators TPM.

PEK\_W03 - Knows the basic features and capabilities of computer systems of the CMMS class supporting scheduling service and repair tasks, inventory management and servicing and repair personnel management.

### II. Relating to skills:

PEK\_U01 - Can use the acquired knowledge to formulate tasks to improve the system of maintenance of manufacturing machinery and equipment.

PEK\_U02 - Is able to determine the indicators covering the progress in the implementation of TPM methodology.

PEK\_U03 - Can use modern IT tools for computerized management of maintenance processes.

### III. Relating to social competences:

PEK\_K01 - Can search and use the recommended literature for the course and independently acquire knowledge.

PEK\_K02 - He can take advantage of modern IT tools.

PEK\_K03 - Understands the need for regular and independent work on the mastery of the course material.

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	The main issues related to maintenance of manufacturing machinery and equipment: performance requirements, the analysis of cause-and-effect machine failure, the role and importance (benefits) of the organization and planning of maintenance	4
Lec2	History and development of the concept of TPM, characteristics of basic pillars of TPM	2
Lec3	Characteristics of the main tools in the field of TPM - examples of their use	4
Lec4	Maintenance strategies - the idea of a systematic and systemic approach to the problem of maintenance	2
Lec5	Measures and indicators determining the effectiveness of the implementation of the TPM methodology	2
Lec6	IT systems of CMMS class, maintenance management support (requirements and functions of selected systems, the selection criteria of the system)	4
Lec7	Implementation of TPM methodology into industrial practice (role of Maintenance and its organization)	2
Lec8	Examples of solutions for the implementation of the TPM	8
Lec9	Test	2
		Total hours: 30
Form of classes – Project		Number of hours
Proj1	Introduction. Presentation of selected modules of the CMMS	3
Proj2	Spare Parts Management. The part card. Warehouse Management. The structure of the module and generated documents	2

Proj3	Fulfilling orders for maintenance. Generating demand for materials and spare parts	2
Proj4	Management of personell that fulfills maintenance activities. Reports from the workload. Planning service orders. The stages and the necessary data. Building schedules for maintenance execution	4
Proj5	Reporting of orders completion. Cost analysis: planned and actual costs. Reports for maintenance indicators	2
Proj6	Project acknowledge	2
		Total hours: 15

TEACHING TOOLS USED

- N1. traditional lecture with the use of transparencies and slides  
N2. self study - preparation for project class

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	Test
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_U01, PEK_U02, PEK_U03 PEK_K01, PEK_K02, PEK_K03	Project defense
P = F1		

PRIMARY AND SECONDARY LITERATURE

#### PRIMARY LITERATURE

1. Legutko S.: Podstawy eksploatacji maszyn i urządzeń. Wyd. WSiP. Warszawa, 2007.
2. Słowiński B.: Inżynieria eksploatacji maszyn. Wyd. Pol. Koszalińskiej. Koszalin, 2011.
3. Kaźmierczak J.: Eksploatacja systemów technicznych. Wyd. Pol. Śląskiej. Gliwice, 2000.

#### SECONDARY LITERATURE

1. Hebda M.: Elementy teorii eksploatacji systemów technicznych. Wyd. MCNEMT. Radom, 1990.
2. Żółtowski B.: Podstawy diagnostyki maszyn. Wyd. ATR Bydgoszcz. Bydgoszcz, 1996.
3. Honczarenko J.: Elastyczna automatyzacja wytwarzania. Obrabiarki i systemy obróbkowe. WNT Warszawa, 2000.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Operartion maintenance of machines and devices**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_ZJ_W09	C1 - C3	Lec1 - Lec8	N1, N2
PEK_U01, PEK_U02, PEK_U03	K2ZIP_ZJ_U04	C1 - C3	Pr1 - Pr5	N2
PEK_K01, PEK_K02, PEK_K03	K2ZIP_K02	C1 - C3	Lec1 - Lec8, Pr1 - Pr5	N1, N2

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Elastyczna automatyzacja wytwarzania**

Name in English: **Flexible manufacturing automation**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Manufacturing Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041206**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30			15	
Number of hours of total student workload (CNPS)	60			60	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	2			2	
including number of ECTS points for practical (P) classes				2	
including number of ECTS points for direct teacher-student contact (BK) classes	1.2			1.4	

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

1. The student has basic knowledge relating to the design-construction process, the structure, functioning and operation of the main machine elements and assemblies and the principles of matching and constructing them.
2. The student has sound knowledge of the structure of machine tools and their functionalities.
3. The student can design the technological process of machining for a given workpiece, selecting proper machine tools and machining tools and parameters for a given production volume and capacity.

### SUBJECT OBJECTIVES

- C1. The student is to get to know the possibilities of automating the different components of a manufacturing system.
- C2. The student is to acquire the skill of designing a flexible manufacturing system for a specified spectrum of workpieces.
- C3. The student is to evaluate various solutions of flexible manufacturing automation.

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - The student knows the structure of the flexible manufacturing system and can describe its main components.

PEK\_W02 - The student knows the functionalities of the manufacturing system and can propose different automation solutions for this system.

PEK\_W03 - The student can distinguish between the flow systems of workpieces, tools, machining fluids and chips and can select their configuration proper for the specific production conditions.

### II. Relating to skills:

PEK\_U01 - The student can analyze a spectrum of workpieces and design a functional flexible manufacturing system configuration.

PEK\_U02 - The student can select a proper system of the flow of tools and organize their circulation according to the technological tasks being carried out.

PEK\_U03 - The student can design a system of the flow workpieces, taking into account the manipulation, transport and storage of the material.

### III. Relating to social competences:

PEK\_K01 - The student understands the need for lifelong learning within the range of production management and engineering activity and improving her/his professional and social competences.

PEK\_K02 - The student is able to think and critically analyze the functioning of the production system in order to increase its effectiveness.

PEK\_K03 - The student is aware of responsibility for her/his own work and its impact on the functioning of the company.

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction, the notion of a system, the manufacturing system.	2
Lec2	The functional structure of the manufacturing system.	2
Lec3	The conditions for the development of the flexible automation of manufacturing.	2
Lec4	Flexible manufacturing system (FMS) implementation concepts.	2
Lec5	Machine tools used in FMS.	2
Lec6	Equipment for burr removal from workpieces in FMS.	2
Lec7	Coolants, chips disposal and washing workpieces in FMS.	2
Lec8	Tool management in FMS.	2
Lec9	Group technology and the structuring of the spectrum of workpieces.	2
Lec10	Handling systems in FMS.	2
Lec11	Transport systems in FMS.	2
Lec12	Storage systems in FMS.	2
Lec13	Information systems in FMS.	2
Lec14	The supervision and diagnosis of FMS operation.	2
Lec15	FMS availability.	2
		Total hours: 30

Form of classes – Project		Number of hours
Proj1	A preliminary presentation of planning process data, an analysis of the spectrum of workpieces on the basis of production drawings and the definition of production parameters.	2
Proj2	The selection of a representative workpiece from the family of workpieces, the selection of operations and cuts, the selection of tools and machining parameters, the calculation of primary and secondary times.	2
Proj3	The selection of FMS components for a group of workpieces.	2
Proj4	Getting acquainted with ProModel simulation systems.	2
Proj5	Data preparation and input into a simulation system.	2
Proj6	Performing simulation computations.	2
Proj7	An analysis of the results and drawing conclusions.	2
Proj8	Discussion of the results	1
		Total hours: 15

TEACHING TOOLS USED	
<p>N1. traditional lecture with the use of transparencies and slides  N2. multimedia presentation  N3. self study - preparation for project class  N4. project presentation  N5. tutorials</p>	

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	colloquium
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_U01, PEK_U02, PEK_U03 PEK_K01, PEK_K02, PEK_K03	grading the project

P = F1

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. Feld M.: Podstawy projektowania procesów technologicznych typowych części maszyn. WNT. 2000
2. Honczarenko J.: Elastyczna automatyzacja wytwarzania. WNT, Warszawa 2000
3. Krzyżanowski J.: Wprowadzenie do elastycznych systemów wytwórczych. Oficyna Wyd. PWr., Wrocław 2005

SECONDARY LITERATURE

1. Kief H.B.: FFS-Handbuch, Carl Hanser Verlag 1998
2. Luggen W.W.: Flexible manufacturing cells and systems, Prentice-Hall Int. Editions, 1991

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Flexible manufacturing automation**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_OP_W02, K2ZIP_W07	C1, C2		N1, N2
PEK_U01, PEK_U02, PEK_U03	K2ZIP_OP_U02, K2ZIP_U07	C3	Proj1 - Proj8	N3, N4, N5
PEK_K01, PEK_K02, PEK_K03	K2ZIP_K01, K2ZIP_K03, K2ZIP_K05	C3	Proj1 - Proj8	N3, N4, N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

### SUBJECT CARD

Name in Polish: **Inżynieria odwrotna**

Name in English: **Reverse Engineering**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Manufacturing Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041207**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15		15		
Number of hours of total student workload (CNPS)	30		30		
Form of crediting	Crediting with grade		Crediting with grade		
Group of courses					
Number of ECTS points	1		1		
including number of ECTS points for practical (P) classes			1		
including number of ECTS points for direct teacher-student contact (BK) classes	0.6		0.7		

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

1. Student has a basic knowledge of machine design and manufacturing technologies.
2. Student has a knowledge of Computer Aided Design (CAD).
3. Student has a knowledge of geometrical metrology.

### SUBJECT OBJECTIVES

- C1. Providing students with knowledge of application areas of reverse engineering.
- C2. Providing students with knowledge of methods of 3D scanning and reconstructions of 3D CAD models of physical objects.
- C3. Producing in students the ability of applying data from 3D scanning in the evaluation of the geometrical accuracy of products and in designing new products.

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Student is able to define reverse engineering and describe its basic applications.

PEK\_W02 - Student is able to characterize the process of reconstruction of the CAD model.

PEK\_W03 - Student is able to choose a 3D scanning method depending on the type of the object to be digitized.

### II. Relating to skills:

PEK\_U01 - Students can evaluate the data from 3D scanning and perform basic editing operations.

PEK\_U02 - Student can perform the process of comparison a model from 3D scanning with CAD data.

PEK\_U03 - Student is able to use data from a 3D scanner to design a new product.

### III. Relating to social competences:

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction. Application areas of reverse engineering.	2
Lec2	Contact methods of data acquisition . Technical and medical tomography.	2
Lec3	Optical methods of data acquisition.	2
Lec4	Basic methods of reconstructing of CAD models in reverse engineering.	2
Lec5	Advanced reconstruction methods. Assessment of accuracy in reverse engineering.	2
Lec6	Non-commercial 3D scanning systems - application areas, assessment of accuracy. Presentation of a selected device.	2
Lec7	Case study.	2
Lec8	Final test	1
		Total hours: 15
Form of classes – Laboratory		Number of hours
Lab1	Introduction. Presentation of 3D scanners. 3D scanning of a selected object.	2
Lab2	Learning the program interface. Import and basic editing operations on 3D scanning data.	2
Lab3	Orientation of models in space, best-fit function. Comparison of two models, and generating deviation maps.	2
Lab4	Advanced inspection functions.	2
Lab5	NURBS surface modeling - the basics.	4
Lab6	Integrating the CAD model with data from 3D scanning.	2
Lab7	Assessment	1
		Total hours: 15

## TEACHING TOOLS USED

- N1. multimedia presentation
- N2. traditional lecture with the use of transparencies and slides
- N3. case study
- N4. self study - preparation for laboratory class
- 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_W02, PEK_W03	final 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_U01, PEK_U02, PEK_U03	laboratory report
P = F1		

## PRIMARY AND SECONDARY LITERATURE

### PRIMARY LITERATURE

- [1] Raja V., Fernandes K.J.: Reverse engineering: an industrial perspective, Springer, 2008, 242s.
- [2] Chlebus E.: Techniki komputerowe CAx w inżynierii produkcji, WNT, Warszawa 2000

### SECONDARY LITERATURE

- [1] Chlebus E., Dybała E.: Reverse engineering in technical and medical applications, Virtual design and automation. 1st VIDA International Conference, Poznań, 3-4 June 2004, 2005, Str. 213-218
- [2] Oczóś K., Cena I.: Rapid Inspection - metody pomiarowo-kontrolne adekwatne do rapid-technologii, Mechanik, 2008, No. 3, Str. 165-176
- [3] Gawlik J., Karbowski K.: Metody odwzorowywania powierzchni w systemach inżynierii odwrotnej, Zeszyty Naukowe Politechniki Poznańskiej, Budowa Maszyn i Zarządzanie Produkcją, 2004, No. 1, Str. 187-194

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Reverse Engineering**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_W04	C1-C2	Lec1-Lec8	N1-N3, N5
PEK_U01, PEK_U02, PEK_U03	K2ZIP_OP_U03	C3	Lab1-Lab7	N4-N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

### SUBJECT CARD

Name in Polish: **Mapowanie procesów w przedsiębiorstwie**

Name in English: **Enterprise processes mapping**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Manufacturing Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041208**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15			15	
Number of hours of total student workload (CNPS)	30			60	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	1			2	
including number of ECTS points for practical (P) classes				2	
including number of ECTS points for direct teacher-student contact (BK) classes	0.6			1.4	

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

1. Enhanced knowledge of the enterprise operation in terms of management and production.
2. The ability to obtain information from documents, databases and other sources, the ability to interpret information.

### SUBJECT OBJECTIVES

- C1. Acquisition of basic knowledge about analysis methods and business processes documentation.
- C2. Acquisition of skills how to use the basic tools used in the process mapping in production enterprises.
- C3. Acquisition of skills how to recognize the resources and information flow of across the enterprise.

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Student has knowledge about analysis methods and business processes documentation.

PEK\_W02 - Student can characterize resources and information flow in enterprise. He can describe their flow.

PEK\_W03 - Student can choose different tools and methods to analyze enterprise processes.

### II. Relating to skills:

PEK\_U01 - Student has the ability to use different tools of process mapping.

PEK\_U02 - Student can use computer aided tools in process modeling.

PEK\_U03 - Student can analyze models within compliance with the notation, accuracy and efficiency of modeling techniques.

### III. Relating to social competences:

PEK\_K01 - Student thinks and acts in a creative and enterprising way.

PEK\_K02 - Student is able to interact and work in a group, taking the different roles as a different functions in manufacturing and service enterprises.

PEK\_K03 - Student understands the need for continuous improvement of the organization, its processes and products.

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Presentation of basics of business processes mapping. Presentation of process definitions and basic information about process modeling. Presentation of basic ways of describing processes in enterprise.	2
Lec2	Presentation of process modeling using BPMN, discussion of basic concepts. Presentation of the scope of BPMN and its notation elements. Presentation how to create maps in BPMN. Presentation of the practical use of BPMN in enterprises.	4
Lec3	Presentation of process modeling using Value Stream Mapping (VSM), discussion of basic concepts. Presentation of the scope of VSM and its notation elements. Presentation how to create current state maps in VSM. Waste identification. Presentation how to create future state maps in VSM. Presentation of the practical use of VSM in enterprises.	4
Lec4	Presentation of process modeling using functional maps, discussion of basic concepts. Presentation of the scope of functional maps and its notation elements. Presentation how to create functional maps. Presentation of the practical use of functional maps in enterprises.	4
Lec5	Test	1
		Total hours: 15
Form of classes – Project		Number of hours
Proj1	Designing of observation method for mapping. Preparation of information for the analysis of the process.	6
Proj2	Production processes mapping with VSM notation. Current state map.	3
Proj3	Enterprise processes mapping with IDEF0 lub BPMN notation.	2

Proj4	Development of process improvements in VSM notation. Furute state map.	2
Proj5	Project presentation.	2
		Total hours: 15

TEACHING TOOLS USED		
N1. case study		
N2. self study - preparation for project class		
N3. project presentation		
N4. traditional lecture with the use of transparencies and slides		

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	Colloquium
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_U01, PEK_U02, PEK_U03, PEK_K01, PEK_K02, PEK_K03	project presentation
P = F1		

PRIMARY AND SECONDARY LITERATURE		
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#### PRIMARY LITERATURE

1. Drejewicz S., „Zrozumieć BPMN modelowanie procesów biznesowych”, Helion, Gliwice 2012
2. Rother M., Shook J. „Naucz się widzieć. Eliminacja marnotrawstwa poprzez Mapowanie Strumienia Wartości”, WCTT Wrocław 2003 r.,
3. Rummler A. P., Brache A. P., „Podnoszenie efektywności organizacji”, PWE, Warszawa 2000 r.,

#### SECONDARY LITERATURE

1. Skrzypek E., Hofman M., "Zarządzanie procesami w przedsiębiorstwie : identyfikowanie, pomiar, usprawnianie", Wolters Kluwer Polska, Warszawa 2010

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Enterprise processes mapping**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_OP_W02, K2ZIP_W02, K2ZIP_W07	C1, C2, C3	Lec 1 - Lec 4	N4
PEK_U01, PEK_U02, PEK_U03,	K2ZIP_OP_U03, K2ZIP_OP_U04, K2ZIP_U09	C1, C2, C3	Proj 1 - Proj 4	N1, N2, N3
PEK_K01, PEK_K02, PEK_K03	K2ZIP_OP_K01	C1, C2, C3	Proj 1 - Proj 4	N1, N2, N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Recykling materiałów**

Name in English: **Recycling of materials**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Manufacturing Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041209**

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					
including number of ECTS points for direct teacher-student contact (BK) classes	1.2				

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

1. The student has a basic knowledge of the properties of materials.

### SUBJECT OBJECTIVES

- C1. Acquisition of basic knowledge about the life cycle of the product and the disposal methods of the product. Acquisition of basic knowledge about recycling methods.
- C2. Understanding the need for waste management policy. Understanding the design and manufacture of the product in the context of environmental impact.
- C3. The acquisition and consolidation of social skills like responsibility, honesty, fairness in the procedure observance force in academia.

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Defining and understanding the issues of product life cycle.

PEK\_W02 - Identifying recycling methods.

PEK\_W03 - The presentation and characterization of waste management methods.

### II. Relating to skills:

### III. Relating to social competences:

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Organizational matters. The life cycle of the product. The problem of waste. European scale of the problem. The situation in Poland. Legislative considerations.	2
Lec2	General information about recycling. Balance of environmental burdens. Ekobilansu importance in the economy. Methods of waste disposal and waste products.	2
Lec3	Technical possibilities of identification and separation of materials.	2
Lec4	The problems of recycling polymeric materials. Classification of methods for recycling of polymeric materials. Methods for managing selected polymers as an example of recycling.	4
Lec5	Feedstock recycling for selected examples.	4
Lec6	Thermal recycling for selected examples.	4
Lec7	Recycling and characterization of materials in various industries. Recycling of packaging materials. Recycling of materials in the automotive industry. Recycling of waste electrical.	4
Lec8	Degradable materials as an alternative to recycling.	4
Lec9	Designing. Trends and prospects of recycling materials.	2
Lec10	Summary knowledge of recycling.	2
		Total hours: 30

## TEACHING TOOLS USED

N1. problem lecture

N2. multimedia presentation

N3. tutorials

N4. traditional lecture with the use of transparencies and slides

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 and oral test
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Plastics recycling in Europe, Marek Kozłowski 2006;

SECONDARY LITERATURE

Recycling of plastics, Andrzej Błędzki; Recovery and recycling of plastics, Jacek Kijeński, Andrzej Błędzki, Regina Jeziórska; Selected aspects of car recycling, Jerzy Osiński, Piotr Żach

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Recycling of materials**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_OP_W01	C1, C2, C3	Lec1-Lec10	N1, N2, N3, N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Zarządzanie cyklem życia produktu**

Name in English: **Product Lifecycle Management**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Manufacturing Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041210**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30			15	
Number of hours of total student workload (CNPS)	60			60	
Form of crediting	Examination			Crediting with grade	
Group of courses					
Number of ECTS points	2			2	
including number of ECTS points for practical (P) classes				2	
including number of ECTS points for direct teacher-student contact (BK) classes	1.2			1.4	

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

1. knowledge of IT systems in the manufacturing
2. knowledge of the new product development process
3. knowledge, including practical CAD systems

### SUBJECT OBJECTIVES

- C1. The aim of the course is to provide knowledge about the principles and importance of product lifecycle management, ie from its inception until its disposal in manufacturing systems.
- C2. The aim of the course is to provide basic information about the methods and techniques of managed of the product life stages.
- C3. Will be presented and used the latest solutions that support the work of the product lifecycle management, including tools of the PLM family (Product Lifecycle Management).

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - knowledge of the role and function of PLM in the manufacturing

PEK\_W02 - knowledge of the role and functions of a PDM system in the manufacturing

PEK\_W03 - understanding of the importance of integration and process approach in the organization of the production system

### II. Relating to skills:

PEK\_U01 - ability to model a new product - design and technological documentation

PEK\_U02 - team management skills development

PEK\_U03 - ability of modeling workflows

### III. Relating to social competences:

PEK\_K01 - Think and act in a logical manner

PEK\_K02 - Can draw logical conclusions and resolve problem.

PEK\_K03 - Able to prioritize appropriately for tasks implementation specified by you or others.

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction to subject	2
Lec2	Managing product development - design	2
Lec3	IT systems in Product Development	2
Lec4	Product data management - project, BOM	2
Lec5	Product Lifecycle Management	2
Lec6	The importance of product lifecycle management	2
Lec7	Trends in Product Lifecycle Management	2
Lec8	Workflow management	2
Lec9	Managing product development - process planning	2
Lec10	Product Data Management - documents, classification	2
Lec11	Zarządzanie danymi produktu - integracja	2
Lec12	Product data management - changes	2
Lec13	Product Lifecycle Management - stages of life	2
Lec14	Standards in PDM / PLM	2
Lec15	PLM Market	2
		Total hours: 30
Form of classes – Project		Number of hours
Proj1	Students will develop a project using the PLM tool. They make modeling of the product, its structure and its manufacturing process. Selected business processes needed to produce the product will be modeled too. Process simulation will be conducted using tools for managing workflow.	15

## TEACHING TOOLS USED

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

## 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	Exam
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_U01, PEK_U02, PEK_U03 PEK_K01, PEK_K02, PEK_K03	project, report
P = F1		

## PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

script: Production Management, Mariusz Cholewa, PhD(Eng.)

SECONDARY LITERATURE

PDMA Handbook of New Product Development (2nd Edition); Edited by: Kahn, Kenneth B. © 2005 John Wiley & Sons

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Product Lifecycle Management**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_OP_W01	C1, C2	Wy1 - Wy15	N1, N3, N4
PEK_U01, PEK_U02, PEK_U03	K2ZIP_OP_U01, K2ZIP_OP_U03, K2ZIP_OP_U04, K2ZIP_OP_U07	C3	Pr1	N1, N2, N5
PEK_K01, PEK_K02, PEK_K03	K2ZIP_K03, K2ZIP_OP_K01, K2ZIP_OP_K02	C1, C3	Pr1	N1, N2

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Studium przypadku**

Name in English: **Case study**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Manufacturing Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041212**

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					
including number of ECTS points for direct teacher-student contact (BK) classes	1.2				

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

1. Has knowledge of scientific projects - research and industrial
2. Can prepare an offer in the form of research project proposal and research offer for the company

### SUBJECT OBJECTIVES

- C1. Explain the principle of scientific - research projects
- C2. Explain methods of scheduling and budgeting in research projects
- C3. Explain the principles of substantive implementation of research projects



## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Able to define the purpose and effect of the proposed research topics

PEK\_W02 - Can suggest the mode of applying for project

PEK\_W03 - Can distinguish between basic research and applied research and development

### II. Relating to skills:

### III. Relating to social competences:

PEK\_K01 - Able to work in a team

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction	2
Lec2	Types of projects	2
Lec3	Application Form	2
Lec4	Basic Research Projects	2
Lec5	Research and Development Projects	2
Lec6	Industrial Research Projects	2
Lec7	Funding agencies	2
Lec8	Structural Funds	2
Lec9	Preparation of the draft	2
Lec10	Summary of the preliminarily - application part	2
Lec11	Research project (one executor) - a case study	2
Lec12	Research project (consortium) - a case study	2
Lec13	Research project - Structural Funds - a case study	2
Lec14	Summary	2
Lec15	Examination	2
		Total hours: 30

## TEACHING TOOLS USED

N1. case study

N2. tutorials

N3. multimedia presentation

N4. project presentation

N5. informative lecture

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	test
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Project Management - Case Studies - Harold Kerzner, HELION publishing house

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Case study**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_OP_W05, K2ZIP_W01	C1, C2, C3	Lec1-Lec15	N1, N2, N3, N4, N5
PEK_K01	K2ZIP_K03, K2ZIP_K05	C1, C2, C3	Lec1-Lec15	N1, N2, N3, N4, N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Przedsiębiorczość innowacyjna**

Name in English: **Innovative Entrepreneurship**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Quality Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041213**

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)	30				
Form of crediting	Crediting with grade				
Group of courses					
Number of ECTS points	1				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	1.2				

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

1. General knowledge about the free market economy.
2. Ability to discuss and present one's opinion in terms of dealing with problems connected with the business idea implementation and assessment of its innovation potential.
3. Bachelor's degree and basic knowledge of finance (profit, loss, income, expenses, liquidity, balance, taxes).

### SUBJECT OBJECTIVES

- C1. To familiarize students with the phenomenon of entrepreneurship from the business process point of view that relates entrepreneurship and business.
- C2. To familiarize students with the modern understanding of innovative entrepreneurship, innovation sources and innovation organization management (integrating technological, market and organizational changes).
- C3. To familiarize students with the factors of success or factors of failure of the company, their measures and sources, finding funding sources innovative enterprises.

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Has knowledge of ways and methods of project management, organization, planning and evaluation work in the project, knows methods of technical and economical evaluation of the innovative enterprises.

PEK\_W02 - Knows methods and ways of how to assess opportunities and risks in the scope of innovative activity.

PEK\_W03 - Knows how to assess and verify entrepreneurial activities that are a way of entrepreneurship realization.

### II. Relating to skills:

#### III. Relating to social competences:

PEK\_K01 - Can search for information and analyze them critically.

PEK\_K02 - Acting in a creative and enterprising way can work in a team in the scope of the selection of strategies and tools to

solve problems related to entrepreneurship and innovation.

PEK\_K03 - Can objectively evaluate the arguments, rationally explain and justify their point of view in terms of entrepreneurial activities with the use of knowledge in the fields of innovation and business practices.

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Organizational issues. The core of innovative entrepreneurship. The development of entrepreneurship in Poland and abroad.	2
Lec2	The entrepreneur. His qualities and competences. Personality approach. Characteristics of entrepreneurs; entrepreneurial orientation, sources of the entrepreneurial motivation. Methods of the entrepreneurship completion.	2
Lec3	Sources of inspiration for business ideas. The concept of realization - a system approach.	2
Lec4	The innovativeness imperative. Definitions of key terms of innovations management. Innovation as the basis for entrepreneurial activities.	2
Lec5	The innovation process. Types of innovation and risk. Sources of innovation.	2
Lec6	The selection of methods of searching for innovative solutions.	2
Lec7	Evaluation and selection of optimal variants of solutions.	2
Lec8	Methods for designing innovative products and processes. Intellectual property.	2
Lec9	Determinants and ways of development of innovative enterprises. Development methods, critical moments, learning, the social networks.	2
Lec10	Building the founding team.	2
Lec11	Market segmentation, targeting, user profiles, defining the model user.	2
Lec12	External conditions for entrepreneurship: legal forms, commitment to the environment. Financing projects.	2
Lec13	Building a business plan.	2
Lec14	Corporate entrepreneurship.	2
Lec15	Test.	2
		Total hours: 30

## TEACHING TOOLS USED

- N1. traditional lecture with the use of transparencies and slides  
 N2. problem lecture  
 N3. case study

## 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 test
P = F1		

## PRIMARY AND SECONDARY LITERATURE

### PRIMARY LITERATURE

- [1] B. Glinka, S. Gudkova, *Przedsiębiorczość*, Wolters Kluwer Business, Warszawa 2011  
 [2] J. Targalski, A. Francik, *Przedsiębiorczość i zarządzanie firmą. Teoria i praktyka*, C.H. Beck, Warszawa 2009  
 [3] R. Knosala, A. Boratyńska-Sala, M. Jurczyk-Bunkowska, A. Moczala, *Zarządzanie innowacjami*, PWE, Warszawa 2014  
 [4] P. Drucker, *Innowacja i przedsiębiorczość. Praktyka i zasady*, PWE, Warszawa 1992  
 [5] J. Bessant, J. Tidd, *Innovation and Entrepreneurship*, Wiley and Sons, Chichester 2013  
 [6] W. Bygrave, A. Zacharakis, *Entrepreneurship*, 2nd Edition, Wiley, 2011  
 [7] P. Westhead, M. Wright, G. McElwee, *Entrepreneurship. Perspectives and Cases*, Pearson, Essex 2011

### SECONDARY LITERATURE

- [1] Harvard Business Review Polska, *Sztuka przedsiębiorczości*, ICAN Institute, Warszawa 2013  
 [2] B. Aulet, *Przedsiębiorczość zdyscyplinowana. Od startupu do sukcesu w 24 krokach*, Helion, Gliwice 2014  
 [3] J. Cieślik, *Przedsiębiorczość dla ambitnych. Jak uruchomić własny biznes*, Wydawnictwa Akademickie i Profesjonalne, Warszawa 2010  
 [4] M. E. Gordon, *Uniwersytet Donalda Trumpa. Przedsiębiorczość*, Helion, Gliwice 2009  
 [5] M. Jankowski, *Mała wielka firma. 7 sekretów efektywnego zarządzania*, Studio EMKA, Warszawa 2008

## MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT **Innovative Entrepreneurship** AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Management and Manufacturing Engineering**

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	K2ZIP_W01	C1, C2, C3	Wy1 - Wy15	N1, N2, N3
PEK_K01, PEK_K02, PEK_K03	K2ZIP_K03, K2ZIP_K05	C1, C2, C3	Wy1 - Wy15	N1, N2, N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Przedsiębiorczość innowacyjna**

Name in English: **Innovative Entrepreneurship**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Manufacturing Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041213**

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)	30				
Form of crediting	Crediting with grade				
Group of courses					
Number of ECTS points	1				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	1.2				

## PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. General knowledge about the free market economy.
2. Ability to discuss and present one's opinion in terms of dealing with problems connected with the business idea implementation and assessment of its innovation potential.
3. Bachelor's degree and basic knowledge of finance (profit, loss, income, expenses, liquidity, balance, taxes).

## SUBJECT OBJECTIVES

- C1. To familiarize students with the phenomenon of entrepreneurship from the business process point of view that relates entrepreneurship and business.
- C2. To familiarize students with the phenomenon of entrepreneurship from the business process point of view that relates entrepreneurship and business.
- C3. To familiarize students with the phenomenon of entrepreneurship from the business process point of view that relates entrepreneurship and business.

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Has knowledge of ways and methods of project management, organization, planning and evaluation work in the project, knows methods of technical and economical evaluation of the innovative enterprises.

PEK\_W02 - Knows methods and ways of how to assess opportunities and risks in the scope of innovative activity.

PEK\_W03 - Knows how to assess and verify entrepreneurial activities that are a way of entrepreneurship realization.

### II. Relating to skills:

#### III. Relating to social competences:

PEK\_K01 - Can search for information and analyze them critically.

PEK\_K02 - Acting in a creative and enterprising way can work in a team in the scope of the selection of strategies and tools to

solve problems related to entrepreneurship and innovation.

PEK\_K03 - Can objectively evaluate the arguments, rationally explain and justify their point of view in terms of entrepreneurial activities with the use of knowledge in the fields of innovation and business practices.

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Organizational issues. The core of innovative entrepreneurship. The development of entrepreneurship in Poland and abroad.	2
Lec2	The entrepreneur. His qualities and competences. Personality approach. Characteristics of entrepreneurs; entrepreneurial orientation, sources of the entrepreneurial motivation. Methods of the entrepreneurship completion.	2
Lec3	Sources of inspiration for business ideas. The concept of realization - a system approach.	2
Lec4	The innovativeness imperative. Definitions of key terms of innovations management. Innovation as the basis for entrepreneurial activities.	2
Lec5	The innovation process. Types of innovation and risk. Sources of innovation.	2
Lec6	The selection of methods of searching for innovative solutions.	2
Lec7	Evaluation and selection of optimal variants of solutions.	2
Lec8	Methods for designing innovative products and processes. Intellectual property.	2
Lec9	Determinants and ways of development of innovative enterprises. Development methods, critical moments, learning, the social networks.	2
Lec10	Building the founding team.	2
Lec11	Market segmentation, targeting, user profiles, defining the model user.	2
Lec12	External conditions for entrepreneurship: legal forms, commitment to the environment. Financing projects.	2
Lec13	Building a business plan.	2
Lec14	Corporate entrepreneurship.	2
Lec15	Test.	2
		Total hours: 30



## TEACHING TOOLS USED

- N1. traditional lecture with the use of transparencies and slides  
 N2. problem lecture  
 N3. case study

## 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 test
P = F1		

## PRIMARY AND SECONDARY LITERATURE

### PRIMARY LITERATURE

- [1] B. Glinka, S. Gudkova, *Przedsiębiorczość*, Wolters Kluwer Business, Warszawa 2011  
 [2] J. Targalski, A. Francik, *Przedsiębiorczość i zarządzanie firmą. Teoria i praktyka*, C.H. Beck, Warszawa 2009  
 [3] R. Knosala, A. Boratyńska-Sala, M. Jurczyk-Bunkowska, A. Moczala, *Zarządzanie innowacjami*, PWE, Warszawa 2014  
 [4] P. Drucker, *Innowacja i przedsiębiorczość. Praktyka i zasady*, PWE, Warszawa 1992  
 [5] J. Bessant, J. Tidd, *Innovation and Entrepreneurship*, Wiley and Sons, Chichester 2013  
 [6] W. Bygrave, A. Zacharakis, *Entrepreneurship*, 2nd Edition, Wiley, 2011  
 [7] P. Westhead, M. Wright, G. McElwee, *Entrepreneurship. Perspectives and Cases*, Pearson, Essex 2011

### SECONDARY LITERATURE

- [1] *Harvard Business Review Polska, Sztuka przedsiębiorczości*, ICAN Institute, Warszawa 2013  
 [2] B. Aulet, *Przedsiębiorczość zdyscyplinowana. Od startupu do sukcesu w 24 krokach*, Helion, Gliwice 2014  
 [3] J. Cieślík, *Przedsiębiorczość dla ambitnych. Jak uruchomić własny biznes*, Wydawnictwa Akademickie i Profesjonalne, Warszawa 2010  
 [4] M. E. Gordon, *Uniwersytet Donalda Trumpa. Przedsiębiorczość*, Helion, Gliwice 2009  
 [5] M. Jankowski, *Mała wielka firma. 7 sekretów efektywnego zarządzania*, Studio EMKA, Warszawa 2008

## MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT **Innovative Entrepreneurship** AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Management and Manufacturing Engineering**

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	K2ZIP_W01	C1, C2, C3	Wy1 - Wy15	N1, N2, N3
PEK_K01, PEK_K02, PEK_K03	K2ZIP_K03, K2ZIP_K05	C1, C2, C3	Wy1 - Wy15	N1, N2, N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

### SUBJECT CARD

Name in Polish: **Zarządzanie projektami i innowacjami**

Name in English: **Project and innovation management**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Manufacturing Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041214**

Group of courses: **no**

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

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

1. Basics knowledge of management and marketing
2. Knowledge of the techniques and methods in the area of production management and services
3. Skills in information technology

### SUBJECT OBJECTIVES

- C1. To familiarize students with the objectives and concepts of project management and innovation
- C2. Way of presenting problems and procedures to be followed in the implementation of project tasks
- C3. Implementation to the appropriate software (eg MS Project)
- C4. Teamwork skills
- C5. Way of presentation of project tasks

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Has knowledge of the procedures and techniques of project management

PEK\_W02 - Understands the relationships and dependencies between the general objectives and sub-objectives of the project and the risks of the project

### II. Relating to skills:

PEK\_U01 - Has the ability to carry out simple and complex operations using the procedures and techniques of project management

PEK\_U02 - It has the ability to use the resources for the implementation of information technology and project management

### III. Relating to social competences:

PEK\_K01 - Is aware of the increasing importance of project management and innovation in solving technical problems, economic and social

PEK\_K02 - The gradual acquisition of competence to work under the direction of a team leader, in terms of competitiveness

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	The scope of the lecture, assessment and literature. Introduction.	2
Lec2	Factors causing the change and the need for the organization by the project. Definitions and objectives of characterizing the type of project tasks. Components (elements) of the project.	2
Lec3	Basic types of projects (internal and external). Measures of success of the project. Measures of success of the project. The structure of the project. The management and nine areas of project management competence	2
Lec4	Initiating the project. Determining the actual requirements for the design and purpose of the project. List the needs of the project, limitations of the feasibility, cost analysis and recommendations for the project. Outline of the project	2
Lec5	Planning for the project. The main and sub objectives of the project. Decomposition-pyramid du Pont. The scope, impact and limitations of the project. Definition of the approach and identify of required resources. Inventory and Evaluation of the people involved in the project. Critical success factors.	2
Lec6	Project control plans and creation of a structure analysis of the work. The communication plan. The control plan design changes. Quality management plan and a plan of supply. Plan completion. The approach to the structure analysis of the work. Determination of levels of supervision	2
Lec7	Development of the project plan details. The selection of the project team:. Estimating the cost and duration of the project. Gantt Chart. Network diagrams CPM and PERT. Determining the project schedule. The risk of the project. Alternative plans	2
Lec8	Software description eg: MS Project. Closing the project: project evaluation and report on the implementation of the project, conclusions and experience.	2

Lec9	Basic concepts related to the development of technology: knowledge, research, scientific discoveries, inventions, innovations, patents, utility and industrial models, deployment and transfer	2
Lec10	Methods to stimulate creativity and innovation. Methods and techniques for generating, collecting, analyzing and selecting solutions. Measures of Technical Strategy: the intensity of R & D, sales of new products. Lean Manufacturing	2
Lec11	Software R & D and innovation strategy company a) the evolution of the management of R & D, b) development of products and processes, c) the dynamics of the market and the R & D, d) R & D programs .	2
Lec12	Technology transfer and innovation: - Types of licenses, - Forms of transfer and acquisition of technology, - Marketing of innovative technologies and attitudes, - Managing the implementation and improvement, - Technology transfer as a matter of national	2
Lec13	Institutional and organizational forms of innovation: - Innovation Relay Centres IRC FEMIRC, - Incubators, - Technology transfer centers, - etc	2
Lec14	The standards and specifications. Product certification and accreditation of institutions. Requirements of the EU Directive	2
Lec15	Final exam	2
		Total hours: 30
Form of classes – Project		Number of hours
Proj1	Scope of the project, assessment. Create teams. Generating project topics	2
Proj2	Presentation topics by leaders (or other members of the group), including project initiation phase	2
Proj3	Discussion about the merits of the presented projects, corrections and additions	2
Proj4	The planning phase of the project. Main and sub-objectives, the impact of the project	2
Proj5	The organizational structure of the project- presentation and discussion. Project control plan.	2
Proj6	Cost analysis, end of project	2
Proj7	Presentation in front of students and teacher. Assessment of the project	3
		Total hours: 15

#### TEACHING TOOLS USED

- N1. informative lecture
- N2. problem lecture
- N3. self study - preparation for project class
- N4. project presentation

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	Colloquium
P =		

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_K01, PEK_K02	Presentation and of the project
P =		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Mingus N.: Zarządzanie projektami, Wyd. Helion, Gliwice 2002 ,  
 Kerzner H.: Advanced Project Management, edycja polska, Wyd. ONE PRESS, 2005,  
 Lowe P.: Zarządzanie technologią. Możliwości poznawcze i szanse. Wyd. Śląsk, Katowice 1999,  
 Dworczyk M. Szlaska R.: Zarządzanie innowacjami. Wpływ innowacji na wzrost konkurencyjności przedsiębiorstw. Oficyna Wyd. Politechniki Warszawskiej, 2001.

SECONDARY LITERATURE

Wilczewski S.: MS Project 2003 Zarządzanie projektami,  
 Burton c., Michael N.: Zarządzanie projektami, Wyd. ASTRUN, Wrocław 1999,  
 Kasprzak W. Pelc K.: Wyzwania technologiczne- prognozy i strategie. Wyd. Profesjonalnej Szkoły Biznesu, Kraków 1999,  
 Mazurkiewicz A.: Modelowanie transformacji wiedzy do praktyki w budowie i eksploatacji maszyn. Wyd. Inst. Technologii Eksploatacji, Radom- Poznań 1999.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Project and innovation management**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_OP_W05	C1, C2	lec1-lec13	N1, N2
PEK_U01, PEK_U02	K2ZIP_U01	C2, C3	Pr1-Pr6	N2, N3
PEK_K01, PEK_K02	K2ZIP_OP_K01, K2ZIP_OP_K02	C4, C5	Pr1-Pr7	N3, N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Seminarium dyplomowe**

Name in English:

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Manufacturing Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041215**

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)					30
Form of crediting					Crediting with grade
Group of courses					
Number of ECTS points					1
including number of ECTS points for practical (P) classes					1
including number of ECTS points for direct teacher-student contact (BK) classes					

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

**I. Relating to knowledge:**

**II. Relating to skills:**

**III. Relating to social competences:**

PROGRAMME CONTENT



Form of classes – Seminar		Number of hours
Sem1		2
Sem2		2
Sem3		2
Sem4		24
		Total hours: 30

TEACHING TOOLS USED
N1. multimedia presentation N2. tutorials N3. problem discussion

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Seminar)		
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	
F2	PEK_K01, PEK_K02, PEK_K03	
P = P=0,8*F1+0,2*F2		

PRIMARY AND SECONDARY LITERATURE
<u>PRIMARY LITERATURE</u>
<u>SECONDARY LITERATURE</u>

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY <b>Management and Manufacturing Engineering</b>				
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_U, PEK_K	K2ZIP_K01, K2ZIP_K05, K2ZIP_U10, K2ZIP_U11, K2ZIP_U14	C1, C2, C3		N1, N2, N3
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SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Monitorowanie i wizualizacja w wytwarzaniu**

Name in English: **Monitoring and Visualisation in Manufacturing**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Manufacturing Management**

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

Kind of subject: **optional**

Subject code: **ZPM041220**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15			30	
Number of hours of total student workload (CNPS)	60			60	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	2			2	
including number of ECTS points for practical (P) classes				2	
including number of ECTS points for direct teacher-student contact (BK) classes	1.2			1.4	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

**I. Relating to knowledge:**

**II. Relating to skills:**

**III. Relating to social competences:**

PROGRAMME CONTENT		
Form of classes – Lecture		Number of hours
Lec1		3
Lec2		3
Lec3		2
Lec4		2
Lec5		2
Lec6		2
Lec7		1
		Total hours: 15
Form of classes – Project		Number of hours
Proj1		4
Proj2		4
Proj3		4
Proj4		4
Proj5		5
Proj6		4
Proj7		5
		Total hours: 30

TEACHING TOOLS USED		
N1. multimedia presentation		
N2. traditional lecture with the use of transparencies and slides		
N3. report preparation		

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	
P =		

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	
P =		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Monitoring and Visualisation in Manufacturing**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_OP_W06, K2ZIP_OP_W07	C1, C2		N1, N2, N3
PEK_U01, PEK_U02, PEK_U03	K2ZIP_OP_U09, K2ZIP_OP_U10, K2ZIP_U04, K2ZIP_U12	C1, C2		N1, N2, N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Symulacja i wizualizacja układów mechanicznych**

Name in English: **Simulation and visualization of mechanical systems**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Manufacturing Management**

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

Kind of subject: **optional**

Subject code: **ZPM041221**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15			30	
Number of hours of total student workload (CNPS)	60			60	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	2			2	
including number of ECTS points for practical (P) classes				2	
including number of ECTS points for direct teacher-student contact (BK) classes	1.2			1.4	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

**I. Relating to knowledge:**

**II. Relating to skills:**

**III. Relating to social competences:**

PROGRAMME CONTENT		
Form of classes – Lecture		Number of hours
Lec1		2
Lec2		2
Lec3		2
Lec4		2
Lec5		3
Lec6		3
Lec7		1
		Total hours: 15
Form of classes – Project		Number of hours
Proj1		2
Proj2		4
Proj3		4
Proj4		4
Proj5		3
Proj6		3
Proj7		3
Proj8		3
Proj9		3
Proj10		1
		Total hours: 30

TEACHING TOOLS USED
N1. multimedia presentation N2. self study - preparation for project class N3. report preparation

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	

P =

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	
P =		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Simulation and visualization of mechanical systems**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_OP_W06, K2ZIP_OP_W07	C1, C2		N1, N2, N3
PEK_U01, PEK_U02, PEK_U03	K2ZIP_OP_U09, K2ZIP_OP_U10, K2ZIP_U04, K2ZIP_U12	C1, C2		N1, N2, N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **PRACA DYPLOMOWA I, II**

Name in English: **MASTER THESIS**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Manufacturing Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041251, ZPM041252**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)				90	
Number of hours of total student workload (CNPS)				600	
Form of crediting				Crediting with grade	
Group of courses					
Number of ECTS points				20	
including number of ECTS points for practical (P) classes				20	
including number of ECTS points for direct teacher-student contact (BK) classes				20.0	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

**I. Relating to knowledge:**

**II. Relating to skills:**

**III. Relating to social competences:**

PROGRAMME CONTENT

TEACHING TOOLS USED

- N1. case study
- N2. tutorials
- N3. self study - self studies and preparation for examination

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**MASTER THESIS**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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_U_01, PEK_U02, PEK_U03	K2ZIP_U12, K2ZIP_U14			
PEK_K01, PEK_K02, PEK_K03	K2ZIP_K04			

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Statystyczne sterowanie jakością**

Name in English: **Statistical quality control.**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Quality Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041301**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15			15	
Number of hours of total student workload (CNPS)	90			90	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses	X				
Number of ECTS points	3			3	
including number of ECTS points for practical (P) classes				3	
including number of ECTS points for direct teacher-student contact (BK) classes	1.8			2.1	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

**I. Relating to knowledge:**

**II. Relating to skills:**

**III. Relating to social competences:**

PROGRAMME CONTENT		
Form of classes – Lecture		Number of hours
Lec1		2
Lec2		2
Lec3		2
Lec4		2
Lec5		2
Lec6		2
Lec7		3
		Total hours: 15
Form of classes – Project		Number of hours
Proj1		2
Proj2		2
Proj3		2
Proj4		2
Proj5		2
Proj6		2
Proj7		2
		Total hours: 14

TEACHING TOOLS USED
<p>N1. traditional lecture with the use of transparencies and slides</p> <p>N2. calculation exercises</p> <p>N3. problem exercises</p> <p>N4. self study - preparation for project class</p> <p>N5. problem discussion</p>

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, PEK_K01 - PEK_K02	
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_U01 - PEK_U03, PEK_K01 - PEK_K02	
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Statistical quality control.**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_ZJ_W01, K2ZIP_ZJ_W02	C1		N1, N5
PEK_W02	K2ZIP_ZJ_W01, K2ZIP_ZJ_W02	C1		N1, N5
PEK_W03	K2ZIP_ZJ_W01, K2ZIP_ZJ_W02	C1		N1, N5
PEK_U01	K2ZIP_ZJ_U01, K2ZIP_ZJ_U02	C2, C3		N2, N3
PEK_U02	K2ZIP_ZJ_U01, K2ZIP_ZJ_U02	C2, C3		N2, N3, N4
PEK_U03	K2ZIP_ZJ_U01, K2ZIP_ZJ_U02	C2, C3		N2, N3
PEK_K01	K2ZIP_ZJ_K01, K2ZIP_ZJ_K02	C1,C2,C3		N3, N5
PEK_K02	K2ZIP_ZJ_K01, K2ZIP_ZJ_K02	C1,C2,C3		N3, N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

### SUBJECT CARD

Name in Polish: **Symulacja Lean Manufacturing**

Name in English: **Lean Manufacturing Simulation**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Quality Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041302**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)				15	
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					

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

1. Knows and understands the nature of the production management process.
2. Understands the basic concepts and basic economic rights and economic phenomena and their effects.

### SUBJECT OBJECTIVES

- C1. Deep understanding of Lean Manufacturing concept.
- C2. Understanding the nature of continuous improvement.
- C3. Learning the fundamental Lean Manufacturing methods and gaining confidence about their effectiveness.

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Knows how to implement improvements on the operator work stations using Kaizen principles.

PEK\_W02 - Knows how to use the standardized work and the visual control.

PEK\_W03 - Is able to explain quality at the source principle.

### II. Relating to skills:

PEK\_U01 - Is able to identify 8 types of wastes in production processes.

PEK\_U02 - Is able to distinguish the pull system (both types replenishment and sequential) from push system and knows how to use kanbans.

PEK\_U03 - Can measure the cycle time and the lead time as well calculate takt time.

### III. Relating to social competences:

PEK\_K01 - Knows how to work in team while improving manufacturing system and how important this factor is.

## PROGRAMME CONTENT

Form of classes – Project		Number of hours
Proj1	Presentation of Lean Manufacturing roots and how it was popularized worldwide. Basic definitions. Explanation of adding value and waste.	2
Proj2	Round no 1: Working in simulated factory that manufactures 3 types of products. Watching video from the round no 1. Listing observed problems. Presenting performance indexes, among them 4 principal: number of parts produced, lead time, cost per unit and customer satisfaction.	2
Proj3	Presenting two types of Kaizen and industrial examples of Kaizens. Collecting students ideas for improving the simulated factory.	2
Proj4	Round no 2: Practical implementation of changes and working in simulated factory. Watching video from the round no 2. Listing observed problems. Presenting performance indexes.	2
Proj5	Presenting 3 Lean Manufacturing methods/principles: Quality at the Source, Standardized Work and Pull System. Collecting students ideas for improving the simulated factory using those 3 methods/principles.	2
Proj6	Round no 3: Practical implementation of changes and working in simulated factory. Watching video from the round no 3. Listing observed problems. Presenting performance indexes.	2
Proj7	Presenting Sequential Pull System. Collecting students ideas for improving the simulated factory.	2
Proj8	Round no 4: Practical implementation of changes and working in simulated factory. Presenting performance indexes.	1
		Total hours: 15

## TEACHING TOOLS USED

- N1. laboratory experiment
- N2. problem discussion
- N3. informative lecture

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_W01, PEK_W02, PEK_W03 PEK_U01, PEK_U02, PEK_U03	test
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Lean Lexicon: A Graphical Glossary for Lean Thinkers, Lean Enterprise Institute, Cambridge

Womack J. P., D. T. Jones, Lean Thinking, Free Press, New York 2003

SECONDARY LITERATURE

Womack J.P., Jones D.T., Ross D.: The machine that changed the world, Free Press 1990

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Lean Manufacturing Simulation**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_ZJ_K02	C2	Proj3 - Proj8	N1, N2, N3
PEK_W02	K2ZIP_U07, K2ZIP_ZJ_K02	C3	Proj5, Proj6	N1, N2, N3
PEK_W03	K2ZIP_ZJ_K01, K2ZIP_ZJ_U01	C2, C3	Proj5, Proj6	N1, N2, N3
PEK_U01	K2ZIP_U07, K2ZIP_ZJ_K02	C1, C2	Proj1, Proj2	N1, N2, N3
PEK_U02	K2ZIP_U07	C1, C3	Proj5 - Proj8	N1, N2, N3



PEK_U03	K2ZIP_U07	C1, C3	Proj2, Proj4, Proj5, Proj6, Proj8	N1, N2, N3
PEK_K01	K2ZIP_K04	C1, C2	Proj2 - Proj8	N1, N2

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Systemy zarządzania jakością**

Name in English: **Quality Management Systems**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Quality Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041303**

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					
including number of ECTS points for direct teacher-student contact (BK) classes	1.2				

## PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student has basic knowledge of management:

- (1) has knowledge of the basic management functions, features, goals and structures of organizations;
- (2) knows basic styles, methods and techniques of management;
- (3) understands development trends of management in the context of economic development;
- (4) understands and is able to recognize the impact of existing regulations on organizational and management solutions;
- (5) understands and can name the impact of introduced organizational and management solutions on the economic results of the enterprise;

2. Student has basic knowledge of quality management, mainly:

- (1) knows and understands the basis of modern approach to quality management;
- (2) knows the basic terms used in quality management;
- (3) knows basic methods and tools for quality improvement;
- (4) knows and understands the importance of standards to build quality management systems in enterprises and to ensure quality in the supply chain;

3. She /he has basic knowledge of standardization and certification in the world, in the EU and in his/her EU member state:

- (1) knows general principles of standardization, as well as connections between standardization and development of economy, science and good organizational practices;
- (2) understands and is able to describe the importance of consensus in standardization;
- (3) can name the major standards organizations and identify standards issued by them;
- (4) distinguishes system /process certification from the product and/or personnel certification;
- (5) knows and distinguishes the concepts of accreditation, authorization, notification and certification;

## SUBJECT OBJECTIVES

C1. Obtaining deeper knowledge of the universality of ISO 9000 series standards as generally recognized - in the world, the EU and Poland - basics of quality management system, that can be applied in organizations of any type and size, regardless of the type of delivered "product" and geographic location.

C2. Detailed mastery of fundamental assumptions and terminology of quality management systems compliant with ISO 9000 series standards.

C3. Detailed mastery of a range of basic standardized requirements concerning quality management system and understanding, on examples, the possibility of their differentiated interpretation based on analysis taking into account the type and size of the organization and the level of its development in terms of quality, type of delivered product and represented industry, as well as existing legal regulations.

C4. Mastering the standardized guidelines for conducting audits of quality management system and standardized basis for carrying out consulting in the field of quality management systems.

C5. Acquiring the necessary theoretical basis for the practice of designing, documenting, implementing, reviewing, auditing, certification, maintaining and improving the quality management system in an enterprise and understanding of the need to update the knowledge in this field due to the periodic update of standards.

## SUBJECT EDUCATIONAL EFFECTS

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

PEK\_W01 - Student can characterize the family of ISO 9000 standards considering the scope of application of different standards and their use in the global supply chain. She/ he knows the basic assumptions (according to ISO 9000 and ISO 9001) and the basic requirements (according to ISO 9001) for the standardized quality management systems (QMS) - at least describes in detail the model of system based on a process approach, lists and recognizes the principles of quality management, as well as provides examples of their reflection in the basic requirements for QMS, identifies and describes, as well as explains the requirements for QMS distinguishing requirement groups (QMS processes and documentation, Management responsibility, Resource management, Product realization, Measurement, analysis and improvement). She / he recognizes, describes and explains chosen aspects of the concept of managing aimed at sustained success of an organization with the use of quality management approach (ISO 9004). She/he recognizes, describes and explains chosen aspects of detailing basic ISO 9001 requirements in the industry technical specification ISO / TS 16949, used in series production and in spare parts production in the automotive industry.

PEK\_W02 - Student knows terminology of standardized quality management systems - at least within the scope specified by ISO 9000 standard - she /he defines the terms, selects definitions for the terms , recognizes definitions of terms, recognizes the difference between similar terms and definitions, identifies and enumerates the terms specific for particular aspects of the quality management system, characterizes reasons for terminology changes in the context of standardization principles.

PEK\_W03 - Student knows the standard guidelines for auditing QMS (according to ISO 19011) - identifies and can describe and explain the principles of auditing, management of the audit program, conducting the audit process, requirements for auditors.

She/ he knows the basics of consulting in the field of quality management systems and their practical significance in the light of ISO 10019 guidelines – indicates the reasons for development of ISO 10019, defines and recognizes terms: "Creating a quality management system" and "Consultant for quality management system" , recognizes and describes as well as explains in the basic scope :

- (1)the criteria for the process of selection and evaluation a consultant,
- (2)stages of the implementation process of QMS in the organization,
- (3)the role and tasks of the consultant, top management and the management representative as people co-responsible for the QMS in the organization,
- (4)the ethical requirements consultants should meet.

She/he recognizes and describes the differences and similarities between the role of auditor and the role of consultant.

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

PEK\_U01 - Student is able to apply specialized quality management vocabulary, read with understanding the content of the basic ISO 9000 series standards and give examples of organizational solutions, fulfilling the requirements and guidelines of these standards.

PEK\_U02 - Student is able to determine the basic requirements and guidelines of the basic ISO 9000 series standards for exemplary processes that apply to a quality management system of a typical manufacturing organization.

PEK\_U03 - Student can distinguish the basic requirements explicitly formulated in ISO 9001 standard from the requirements imposed by customer, law or an organization (corporation), etc.

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

PEK\_K01 - Student understands the need for continuous improvement of the organization, its processes and products and the need to focus on customer satisfaction.

PEK\_K02 - Student is aware (1) of the necessity of applying the system and process approach within an organization in order to achieve its quality objectives, and (2) that the scope of ISO 9001 standard requirements is limited to the basic requirements applicable in any organization.

PEK\_K03 - Student is able to think in terms of systemic quality management .

PROGRAMME CONTENT		
Form of classes – Lecture		Number of hours
Lec1	The ISO 9000 family of standards as the basis of standardized quality management systems (QMS) - narrow and wide understanding of the above family, thematic scope and purpose of each standard, history in the context of the functioning of standardization, compatibility of QMS with other management systems, widespread use and importance in the global supply chain, relationships with Polish and EU law, as well as with the CE marking.	2
Lec2	Analysis of the basics of QMS according to ISO 9000 standard, including: 8 quality management principles, process approach, the PDCA cycle.	2
Lec3	Analysis of quality management system terminology according to ISO 9000 standard and its importance.	2
Lec4	The structure of ISO 9001 standard. Introduction to application of ISO 9001 - in the context of a strategic decision of an organization, the factors affecting design and implementation of a QMS in accordance with ISO 9001, the model of a process-based QMS, relationships with ISO 9004 and the compatibility with other systems, purpose of specified requirements, the universal use by any organization and the limitations resulting out of it, references to ISO 9000. General description of the scope of requirements.	2
Lec5	Processes as a basis of QMS, their identifying / establishing and description - analysis of the ISO 9001 requirements with a comment and examples.	2
Lec6	ISO 9001 requirements for documenting QMS, purposes and benefits, criteria for evaluation of the documentation - analysis with a comment and examples.	2
Lec7	Review of ISO 9001 requirements in the scope of specific responsibilities of top management and resource management, with examples of organizational solutions.	2
Lec8	Product realization according to ISO 9001 - analysis of the requirements and their significance in the scope of : (1) planning product realization processes with reference to the general requirements, (2) processes associated with the customer, (3) design and development with particular emphasis on inspection, verification and validation, (4) purchasing , with reference to the existing conditions .	2
Lec9	Product realization according to ISO 9001 - analysis of the requirements and their significance in the scope of: production and service provision (controlled conditions, validation of processes, identification and traceability, customer property protection, preservation of the product and its components) and controlling the equipment for monitoring and measurement, with reference to the existing conditions.	2
Lec10	Review of the ISO 9001 requirements in the scope of measurement and monitoring, analyzing results and improvement. A detailed analysis of the requirements for internal audits, corrective and preventive actions as well as continuous improvement, with a comment and examples.	2
Lec11	Outline of comparative analysis between ISO 9001 and ISO 9004. Chosen aspects of the concept of managing for the sustainable success of an organization by applying quality management-based approach.	2
Lec12	Analysis of normative guidance of ISO 19011 on auditing QMS - principles of auditing, managing audit program, carry out the audit process, requirements for auditors - with a comment and examples.	2

Lec13	Analysis of normative basis for consultancy in the field of quality management systems and their practical relevance in the light of the guidelines of ISO 10019.	2
Lec14	Outline of comparative analysis between ISO 9001 and ISO / TS 16949, an example of technical specification detailing the requirements of ISO 9001 for serial production and spare parts production in the automotive industry. Problems of Implementation and certification of "standardized" QMS.	2
Lec15	Final test.	2
		Total hours: 30

TEACHING TOOLS USED

- N1. traditional lecture using slides
- N2. problem questions
- N3. own work – self-study of the topic and preparation for the final test of the lecture

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, PEK_U01, PEK_U02, PEK_U03, PEK_K01, PEK_K02, PEK_K03,	Final test and scoring active participation in the lecture (which - if a student reaches at least the minimum required for passing the test - could potentially increase the final grade to half a degree up)
P = F1		

PRIMARY AND SECONDARY LITERATURE

## PRIMARY LITERATURE

1. The training materials developed by the lecturer/ lecturers.
2. D. Hoyle,(2009). ISO 9000 quality systems handbook - using the standards as a framework for business improvement . Amsterdam - Boston : Butterworth-Heinemann, 2009.
3. J. Łunarski, Zarządzanie jakością – standardy i zasady, Warszawa: Wydawnictwo Naukowo-Techniczne, 2008.
4. M. Urbaniak, Systemy zarządzania w praktyce gospodarczej, Warszawa: Difin, 2006.
5. M. Wiśniewska, Normy ISO serii 9000:2000. Wymagania, analiza, wdrożenie. Gdańsk: Ośrodek Doradztwa i Doskonalenia Kadr, 2002.
6. PN-EN ISO 9000:2006, Systemy zarządzania jakością - Podstawy i terminologia (idt. ISO 9000:2005, idt. EN ISO 9000:2005) - bilingual English-Polish version.
7. PN-EN ISO 9001:2009, Systemy zarządzania jakością - Wymagania (idt. ISO 9001:2008, idt. EN ISO 9001:2008) - bilingual English-Polish version.
8. Draft International Standard ISO/DIS 9001:2014 (E), Quality management systems - Requirements.

## SECONDARY LITERATURE

1. J. M. Juran, F. J. Gryna, jr., Jakość. Projektowanie. Analiza., Warszawa: Wydawnictwa Naukowo-Techniczne, 1974.
2. W. J. Latzko, D. M. Saunders, Cztery dni z dr. Demingiem. Nowoczesna teoria zarządzania., Warszawa: Wydawnictwa Naukowo-Techniczne, 1998.
3. J. Oakland, P. Morris, "TQM. Ilustrowany przewodnik menedżera", Warszawa: Centrum Informacji Menedżera, 2000.
4. A. Hamrol, Zarządzanie jakością z przykładami, Wyd. 2 zmienione, Warszawa: Wydawnictwo Naukowe PWN, 2008.
5. PN-EN ISO 9004:2010, Zarządzanie ukierunkowane na trwały sukces organizacji - Podejście wykorzystujące zarządzanie jakością (idt. ISO 9004:2009, idt. EN ISO 9004:2009) - Polish version.
6. PN-EN ISO 19011:2012. Wytyczne dotyczące auditowania systemów zarządzania (idt. ISO 19011:2011, idt. EN ISO 19011:2011) - Polish version.

**MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
Quality Management Systems  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
Management and Manufacturing Engineering**

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	K2ZIP_ZJ_W05	C1, C2, C3, C5	Lec1, Lec2, Lec4, Lec5, Lec6, Lec7, Lec8, Lec9, Lec10, Lec11, Lec14, Lec15	N1, N2, N3
PEK_W02	K2ZIP_ZJ_W05	C1, C2, C5	Lec2, Lec3, Lec4, Lec5, Lec6, Lec7, Lec8, Lec9, Lec10, Lec11, Lec15	N1, N2, N3
PEK_W03	K2ZIP_ZJ_W05	C1, C4, C5	Lec12, Lec13, Lec15	N1, N2, N3
PEK_U01	K2ZIP_ZJ_U07	C1, C2, C3, C5	Lec2, Lec3, Lec4, Lec5, Lec6, Lec7, Lec8, Lec9, Lec10, Lec11, Lec12, Lec13, Lec14, Lec15	N1, N2, N3

PEK_U02	K2ZIP_ZJ_U07	C1, C2, C3, C4, C5	Lec4, Lec5, Lec6, Lec7, Lec8, Lec9, Lec10, Lec11, Lec12, Lec13, Lec14, Lec15	N1, N2, N3
PEK_U03	K2ZIP_ZJ_U07	C1, C2, C3, C5	Lec4, Lec5, Lec6, Lec7, Lec8, Lec9, Lec10, Lec11, Lec12, Lec13, Lec14, Lec15	N1, N2, N3
PEK_K01	K2ZIP_ZJ_K02	C2, C3, C5	Lec1, Lec2, Lec3, Lec4, Lec5, Lec6, Lec7, Lec8, Lec9, Lec10, Lec11, Lec12, Lec13, Lec14, Lec15	N1, N2, N3
PEK_K02	K2ZIP_ZJ_K05	C1, C2, C3, C5	Lec1, Lec2, Lec3, Lec4, Lec5, Lec6, Lec7, Lec8, Lec9, Lec10, Lec11, Lec12, Lec13, Lec14, Lec15	N1, N2, N3
PEK_K03	K2ZIP_K01, K2ZIP_K02, K2ZIP_ZJ_K02	C1, C2, C3, C4, C5	Lec1, Lec2, Lec3, Lec4, Lec5, Lec6, Lec7, Lec8, Lec9, Lec10, Lec11, Lec12, Lec13, Lec14, Lec15	N1, N2, N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

### SUBJECT CARD

Name in Polish: **Dokumentowanie i auditowanie systemów zarządzania jakością**

Name in English: **Quality Management Systems Documenting and Auditing**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Quality Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041304**

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)				90	
Form of crediting				Crediting with grade	
Group of courses					
Number of ECTS points				3	
including number of ECTS points for practical (P) classes				3	
including number of ECTS points for direct teacher-student contact (BK) classes				2.1	

## PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student has intermediate knowledge about modern approach to quality management and about quality management systems that conform to standards of the ISO 9000 family , mainly:

- (1) knows and understands the basis of modern approach to quality management;
- (2) knows and understands fundamental assumptions of quality management systems and the whole terminology according to ISO 9000;
- (3) knows and understands in detail the scope of the requirements for a quality management system as defined in ISO 9001
- (4) knows the scope of the guidelines for auditing quality management system, specified in ISO 19011;
- (5) knows and is able to use simple methods and tools for solving problems in order to improve quality;

2. Student has basic knowledge of management:

- (1) has knowledge of the basic management functions, features, goals and structures of organizations;
- (2) knows basic styles, methods and techniques of management;
- (3) understands development trends of management in the context of economic development;
- (4) understands and is able to recognize the impact of existing regulations on organizational and management solutions;
- (5) understands and can name the impact of introduced organizational and management solutions on the economic results of the enterprise;

She/he has basic knowledge of standardization and certification in the world, in the EU and in Poland:

- (1) knows general principles of standardization, as well as connections between standardization and development of economy, science and good organizational practices;
- (2) understands and is able to describe the importance of consensus in standardization;
- (3) can name the major standards organizations and identify standards issued by them;
- (4) distinguishes system /process certification from the product certification and/or personnel certification;
- (5) knows and distinguishes the concepts of accreditation, authorization, notification and certification;

3. Student can develop texts, flowcharts and presentations in electronic form using WORD, VISIO, POWERPOINT software.

She/he has the sense of responsibility for their own work, as well as the willingness to comply with the teamwork rules and to take responsibility for collaborative tasks. She /he knows the basic principles of the teamwork. She/he recognizes the importance of the teamwork in solving problems.

## SUBJECT OBJECTIVES

C1. Strengthening intermediate knowledge in the field of systemic quality management according to ISO 9000, ISO 9001 and ISO 19011, deepening and arranging it for the possibility of practical use on the example of micro-enterprise.

C2. Acquiring basic skills and practical experience in designing, documenting, ensuring consistency, improving, maintaining and auditing the quality management system consistent with ISO 9001 on the example of a micro-enterprise.

C3. Strengthening the skills of cooperation and teamwork, as well as taking various organizational roles in the group, corresponding with various functions in the enterprise - executed in an elementary range associated with designing, documenting, providing consistency, maintaining, improving and auditing the quality management system consistent with ISO 9001, on the example of a micro-enterprise.

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

### II. Relating to skills:

PEK\_U01 - Student is able to communicate using specialized quality management vocabulary , and to interpret the content of ISO 9000, ISO 9001 and ISO 19011 for the application of the requirements and guidelines to an exemplary micro-enterprise.

PEK\_U02 - Student can identify and elementarily describe processes of the quality management system for an exemplary micro-enterprise, as well as create, control and improve selected elements of basic documentation for the system.

PEK\_U03 - Student is able: (1) to gain information from ISO 9001 standard and any quality management system documentation as well as to draw and to formulate conclusions about conformity or nonconformity of the stated facts with the requirements of ISO 9001 (2) and, in the basic range for the examined micro-enterprise, to plan and to carry out as well as to document an audit of selected elements of a quality management system for compliance with ISO 9001.

### III. Relating to social competences:

PEK\_K01 - Student is able: (1) to think creatively and solve problems of documenting quality management system (QMS), also (2) to interact and work in a group, taking various roles corresponding with various functions in the QMS of an enterprise.

## PROGRAMME CONTENT

Form of classes – Project		Number of hours
Proj1	A. Organizational matters. B. Management responsibility in relation to the 8 quality management principles and the PDCA cycle. C. Determining a legal form, a product and an initial organizational structure of micro-enterprises as objects for further group work on the establishment and documentation of the quality management system, ending with a written QMS documentation project generated in controlled conditions.	2
Proj2	A. Overview of selected prepared parts of the documentation project (the effect of the previous hours of design). Determining in the groups the scope and extent of changes to be introduced in their own projects. B. The quality policy and quality objectives as documents of enterprise's QMS.	2
Proj3	A. Overview of selected prepared parts of the documentation project (the effect of the previous hours of design). Determining in the groups the scope and extent of changes to be introduced in their own projects. B. Meeting general requirements concerning quality management system - identification of necessary processes and structure of their connections. Start of works over the processes map of the enterprise.	2
Proj4	A. Overview of selected prepared parts of the documentation project (the effect of the previous hours of design). Determining in the groups the scope and extent of changes to be introduced in their own projects. B. Determining the course of the process of product realization, including monitoring and measurements of compliance.	2

Proj5	A. Overview of selected prepared parts of the documentation project (the effect of the previous hours of design). Determining in the groups the scope and extent of changes to be introduced in their own projects. B. Documented procedures and records required directly by ISO 9001 as well as designing their graphical forms. Other records needed by the organization. Record control procedure.	2
Proj6	A. Overview of selected prepared parts of the documentation project (the effect of the previous hours of design). Determining in the groups the scope and extent of changes to be introduced in their own projects. B. Documents required directly by ISO 9001 and other documents needed by the organization. Document control procedure.	2
Proj7	A. Overview of selected prepared parts of the documentation project (the effect of the previous hours of design). Determining in the groups the scope and extent of changes to be introduced in their own projects. B. Types of actions to be taken in case of disclosure of any non-compliance. Procedure for control of nonconforming product /nonconformity.	2
Proj8	A. Overview of selected prepared parts of the documentation project (the effect of the previous hours of design). Determining in the groups the scope and extent of changes to be introduced in their own projects. B. Corrective action procedure.	2
Proj9	A. Overview of selected prepared parts of the documentation project (the effect of the previous hours of design). Determining in the groups the scope and extent of changes to be introduced in their own projects. B. Preventive action procedure.	2
Proj10	A. Overview of selected prepared parts of the documentation project (the effect of the previous hours of design). Determining in the groups the scope and extent of changes to be introduced in their own projects. B. Internal audit procedure.	2
Proj11	A. Overview of selected prepared parts of the documentation project (the effect of the previous hours of design). Determining in the groups the scope and extent of changes to be introduced in their own projects. B. B. The groups' work on the merging parts of the developed documentation into coherent written projects of QMS documentation - quality manuals for defined micro-enterprises. Sorting and merging the realized introduction exercises into consistent documents to be assessed.	2
Proj12	A. Continuation of the groups' work on the merging parts of the developed documentation into coherent written projects of QMS documentation - quality manuals for defined micro-enterprises. B. Exercises in analyzing and documenting nonconformities as not meeting the requirements of ISO 9001 and presentation of results of completed exercises in the form of a coherent document to be assessed. Preparation of documents directing external teams to conduct an internal audit in particular micro-enterprises within a specified scope regarding documenting QMS in accordance with the requirements of ISO 9001.	2
Proj13	A. Ordering an audit together with submitting micro-enterprise's quality manual. Other activities related to initiating the audit. B. Preliminary review of the micro-enterprise's QMS documentation. Preparation for the implementation of an audit examination of QMS documentation in the micro-enterprise, including creation of a checklist and forms for work records.	2

Proj14	A. The audit examination of QMS documentation in the micro-enterprise - collecting and verifying information, documenting audit evidences by work records, developing audit findings and preparation of audit conclusions. B. Preparation of an audit report, including attachment of work records.	2
Proj15	A. Distribution of the audit report. Completion of the audit and taking the audit follow-up actions. B. Organization of the final stage of the project examination and testing knowledge of the professional terminology.	2
		Total hours: 30

#### TEACHING TOOLS USED

- N1. informational mini-lecture and / or instruction as well as discussion during the course of project  
N2. introductory exercises - analysis and interpretation of the text of the ISO 9001 standard and / or other source documents  
N3. own work – (1) preparation for classes of design and supervision of the QMS documentation and for presentation of developed parts of the QMS documentation project, (2) preparation of coherent QMS documentation, (3) preparation for classes of auditing QMS, (4) preparation of the audit report  
N4. presentation of parts of the QMS documentation project  
N5. work in groups connected with the discussion and / or role playing

#### 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-W01, PEK-W02, PEK_U01	Evaluation of the result of introductory exercises within the analysis and interpretation of the text of ISO 9001 and selected source documents
F2	PEK_W01, PEK_W02	Evaluation of the result of introductory exercises within the comparative analysis of selected requirements of standards ISO 9001, ISO 14001 and PN-N-18001
F3	PEK_W01, PEK_W02, PEK_U01, PEK_U02, PEK_U03, PEK_K01, PEK_K02, PEK_K03,	Evaluation of developed QMS documentation
F4	PEK_W01, PEK_W02, PEK_W03, PEK_U01, PEK_U03	Evaluation of the result of exercises in analysis and description of non-compliance

F5	PEK_W01, PEK_W02, PEK_W03, PEK_U01, PEK_U02, PEK_U03, PEK_K01, PEK_K02, PEK_K03,	Evaluation of the prepared audit report
F6	PEK_W02	Results of test of professional terminology knowledge
F7	PEK_W01, PEK_W02, PEK_W03, PEK_U01, PEK_U02, PEK_U03, PEK_K01, PEK_K02, PEK_K03,	Evaluation of active participation in class (presentation, discussion of the presentation, activity in group work, attendance)
P = ( F1+ F2+ F3 + F4 + F5 + F6 + F7) : 7		

## PRIMARY AND SECONDARY LITERATURE

### PRIMARY LITERATURE

- [1] The training materials developed by the lecturer.
- [2] Exemplary real documents of quality management system from various organizations.
- [3] PN-EN ISO 9001:2009, Systemy zarządzania jakością - Wymagania.
- [4] B. Sujak-Cyruł, Quality Management System. An Introduction to the Project of Documenting and Audit of Quality Management Systems., Wrocław: Wrocław University of Technology & PRINTPAP, 2011.
- [5] D. Hoyle, ISO 9000 quality systems handbook - using the standards as a framework for business improvement ., Amsterdam - Boston : Butterworth-Heinemann, 2009.
- [6] Raport Techniczny ISO/TR 10013, Wytyczne dotyczące dokumentacji systemu zarządzania jakością. Wydanie pierwsze 2001-07-15., Warszawa: PKN, 2002.
- [7] Poradnik Komitetu ISO/TC 176, ISO 9001 dla małych firm. Metody postępowania., Warszawa: PKN, 2003.
- [8] P. Grudowski, Systemy zarządzania jakością wg normy ISO 9001 w małej firmie. Dokumentacja. Wdrożenie. Audit., Bydgoszcz: Wyd. OPO-AJG, 2004 (wyd.II).
- [9] Draft International Standard ISO/DIS 9001:2014 (E), Quality management systems - Requirements.

### SECONDARY LITERATURE

- [1] PN-EN ISO 9000:2006, Systemy zarządzania jakością - Podstawy i terminologia.
- [2] PN-EN ISO 9004:2010, Zarządzanie ukierunkowane na trwały sukces organizacji - Podejście wykorzystujące zarządzanie jakością.
- [3] PN-EN ISO 19011:2012. Wytyczne dotyczące auditowania systemów zarządzania.
- [4] A. Scheibeler, Praktyczne wdrażanie nowej normy ISO 9001:2000., Warszawa: Wydawnictwo WEKA, 2001.
- [5] P. B. Jensen, ISO 9000 - Przewodnik i komentarz., Warszawa: Wyd. Alfa-Wero, 1996.
- [6] Professional magazines: Zarządzanie jakością, Postępy jakości, Zarządzanie przedsiębiorstwem

**MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
Quality Management Systems Documenting and Auditing  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
Management and Manufacturing Engineering**

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	K2ZIP_W10, K2ZIP_ZJ_W06	C1	Proj1 - 15	N1, N2, N3, N4, N5
PEK_W02	K2ZIP_W10, K2ZIP_ZJ_W06	C1	Proj1 - 15	N1, N2, N3, N4, N5
PEK_W03	K2ZIP_W10, K2ZIP_ZJ_W06	C1	Proj10, Proj12 - 15	N1, N2, N3, N5
PEK_U01	K2ZIP_ZJ_U08, K2ZIP_ZJ_U11	C1, C2	Proj1-Proj15	N1, N2, N3, N4, N5
PEK_U02	K2ZIP_ZJ_U09, K2ZIP_ZJ_U11	C1, C2	Proj1 - 12, Proj15	N1, N2, N3, N4, N5
PEK_U03	K2ZIP_ZJ_U07, K2ZIP_ZJ_U08, K2ZIP_ZJ_U09, K2ZIP_ZJ_U11	C1, C2	Proj1 - 15	N1, N2, N3, N4, N5
PEK_K01	K2ZIP_K04, K2ZIP_ZJ_K01, K2ZIP_ZJ_K02	C1, C2, C3	Proj1 - 15	N1, N2, N3, N4, N5
PEK_K02	K2ZIP_ZJ_K02, K2ZIP_ZJ_K06	C1, C2, C3	Proj1 - 15	N1, N2, N3, N4, N5
PEK_K03	K2ZIP_ZJ_K02, K2ZIP_ZJ_K03	C1, C2, C3	Proj10, Proj12 - 15	N1, N2, N3, N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Metody i techniki zapewnienia jakości**

Name in English: **Methods and tools for quality assurance**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Quality Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041305**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30	15		15	
Number of hours of total student workload (CNPS)	60	30		60	
Form of crediting	Examination	Crediting with grade		Crediting with grade	
Group of courses					
Number of ECTS points	2	1		2	
including number of ECTS points for practical (P) classes		1		2	
including number of ECTS points for direct teacher-student contact (BK) classes	1.2			1.4	

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

1. Student knows the contemporary approaches to quality management.
2. Student has got the basic knowledge on manufacturing systems.
3. Student has got the basic knowledge on statistical methods.

### SUBJECT OBJECTIVES

- C1. To get knowledge on methods and tools for quality assurance and quality improvement.
- C2. To acquire the skills in problem analysis by means of quality methods and tools.
- C3. To acquire the skills in team problem solving.



## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Students knows the methods and tools for quality assurance and quality improvement.

PEK\_W02 - Student knows the methods for analysis of cause and effects relationships.

PEK\_W03 - Student has got the knowledge on quality planning and quality engineering methods.

### II. Relating to skills:

PEK\_U01 - Student has got the skills in applying the selected methods of quality assurance and improvement.

PEK\_U02 - Student is able to analyse the cause and effects relationships.

PEK\_U03 - Students has ability to asses the selected system and to indicate its components that require improvement and standardisation.

### III. Relating to social competences:

PEK\_K01 - Student is aware of teamwork in quality management.

PEK\_K02 - Student is aware of how significant is creative thinking problem solving.

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	The role of quality planning, improvement and assurance in quality management.	2
Lec2	Customer satisfaction and loyalty measurement. Kano method.	2
Lec3	Quality Function Deployment (QFD).	2
Lec4	Methods of process mapping.	2
Lec5	Risk analysis - Failure Mode and Effects Analysis in design. Introduction, types of analysis.	2
Lec6	Risk analysis - Failure Mode and Effects Analysis for design and for processes (DFMEA, PFMEA)	2
Lec7	Failure Tree Analysis (FTA).	2
Lec8	Mistake proofing methods (Poka Yoke).	2
Lec9	Methods for cause and effects analysis.	2
Lec10	Analytical methods for cause and effects analysis - hypothesis statement and testing.	2
Lec11	Analytical methods for cause and effects analysis - Generalized Linear Models (ANOVA).	2
Lec12	Analytical methods for cause and effects analysis - independence tests, regression analysis.	2
Lec13	Quality engineering (Robust design) - characteristic, loss functions.	2
Lec14	Quality engineering (Robust design) - parameter design (engineering models and experiments) and tolerance design.	2
Lec15	Quality planning.	2
		Total hours: 30
Form of classes – Classes		Number of hours

CI1	Planning of action needed for customer satisfaction measurement.	2
CI2	Development and analysis of House of Quality within QFD.	2
CI3	Development of process maps and their analysis.	2
CI4	FMEA analysis for selected system, product process.	2
CI5	Planning of one factor experiments and output analysis by means of statistical methods.	2
CI6	Analysis of problem causes by means of statistical methods (hypothesis testing, ANOVA, independence test, correlation and regression analysis).	2
CI7	Development of quality plan for given process.	2
		Total hours: 14
Form of classes – Project		Number of hours
Proj1	QFD analysis for selected product. Teamwork.	2
Proj2	Presentation of projects on QFD analysis for selected product. Teamwork.	2
Proj3	Development of Poka-Yoke solutions for selected process. Teamwork.	2
Proj4	Presentation of Poka-Yoke solutions.	2
Proj5	FMEA analysis for selected product and process. Teamwork.	2
Proj6	Planning, conducting and analysis of one factor experiments for exploring the relationships in selected system.	2
Proj7	Presentation of results for FMEA and conducted experiments.	2
		Total hours: 14

<p>TEACHING TOOLS USED</p> <p>N1. problem exercises  N2. calculation exercises  N3. traditional lecture with the use of transparencies and slides  N4. self study - preparation for project class  N5. project presentation</p>
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<p>EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Lecture)</p>		
<p>Evaluation (F – forming (during semester), P – concluding (at semester end))</p>	<p>Educational effect number</p>	<p>Way of evaluating educational effect achievement</p>
F1	PEK_W01-W03	
P = F1		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Classes)

Evaluation (F – forming (during semester), P – concluding (at semester end))	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01-PEK_U03 PEK_K01-PEK_K02	
P =		

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_U03 PEK_K01-PEK_K02	
P =		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Hamrol A., Zarządzanie jakością z przykładami. Wydawnictwo Naukowe PWN, Warszawa 2011.;

SECONDARY LITERATURE

Konarzewska-Gubała E., Zarządzanie przez jakość : koncepcje, metody, studia przypadków. Wrocław, Wydawnictwo Akademii Ekonomicznej im. Oskara Langego, 2006;

Myszewski J., Po prostu jakość - podręcznik zarządzania jakością. Warszawa, Wydawnictwa Akademickie i Profesjonalne 2009.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Methods and tools for quality assurance**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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
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PEK_W01 - PEK_W03	K2ZIP_ZJ_W01, K2ZIP_ZJ_W02	C1	lec1-15	3
PEK_U01 - PEK_U03	K2ZIP_ZJ_U01, K2ZIP_ZJ_U02	C1, C2	cl1-7	1,2
PEK_K01 - PEK_K02	K2ZIP_K03, K2ZIP_ZJ_K01, K2ZIP_ZJ_K02, K2ZIP_ZJ_U01, K2ZIP_ZJ_U02	C2, C3	p1-7	4,5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Techniczne aspekty zapewnienia jakości**

Name in English: **Technical aspects of quality assurance**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Quality Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041307**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15		15		
Number of hours of total student workload (CNPS)	30		60		
Form of crediting	Crediting with grade		Crediting with grade		
Group of courses					
Number of ECTS points	1		2		
including number of ECTS points for practical (P) classes			2		
including number of ECTS points for direct teacher-student contact (BK) classes	0.6		1.4		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

**I. Relating to knowledge:**

**II. Relating to skills:**

**III. Relating to social competences:**

PROGRAMME CONTENT		
Form of classes – Lecture		Number of hours
Lec1		2
Lec2		2
Lec3		2
Lec4		2
Lec5		2
Lec6		2
Lec7		2
Lec8		1
		Total hours: 15
Form of classes – Laboratory		Number of hours
Lab1		2
Lab2		2
Lab3		2
Lab4		2
Lab5		2
Lab6		2
Lab7		2
Lab8		1
		Total hours: 15

TEACHING TOOLS USED
<p>N1. laboratory experiment            N2. traditional lecture with the use of transparencies and slides            N3. self study - preparation for laboratory class            N4. report preparation</p>

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; PEK_K01 - PEKK02	

P = P

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_K01 -PEK_K02	
F2	PEK_U01 - PEK_U03	

P =

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Technical aspects of quality assurance**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_ZJ_W03, K2ZIP_ZJ_W07	C1, C2		2
PEK_W02	K2ZIP_ZJ_W01, K2ZIP_ZJ_W02, K2ZIP_ZJ_W03	C2, C3		2
PEK_W03	K2ZIP_ZJ_W03	C1, C2		2
PEK_U01	K2ZIP_ZJ_U03	C2		1,3,4
PEK_U02	K2ZIP_ZJ_U02, K2ZIP_ZJ_U03	C3		1,3,4
PEK_U03	K2ZIP_ZJ_U03	C2		1,3,4
PEK_K01	K2ZIP_ZJ_K01, K2ZIP_ZJ_K02	C1-c3		1,2,3,4
PEK_K02	K2ZIP_ZJ_K01, K2ZIP_ZJ_K02	C1-C3		1,2,3,4

SUBJECT SUPERVISOR





Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Systemy zarządzania jakością w laboratoriach**

Name in English: **Quality Management Systems in Laboratories**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Quality Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041308**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15				
Number of hours of total student workload (CNPS)	30				
Form of crediting	Crediting with grade				
Group of courses					
Number of ECTS points	1				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	0.6				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

**I. Relating to knowledge:**

**II. Relating to skills:**

**III. Relating to social competences:**

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1		2
Lec2		2
Lec3		2
Lec4		2
Lec5		2
Lec6		2
Lec7		2
Lec8		1
		Total hours: 15

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides  
N2. problem discussion

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-PEKW03; PEK_K01-PEK_K02;	
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Quality Management Systems in Laboratories**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_ZJ_W05	C1		1,2
PEK_W02	K2ZIP_ZJ_W05	C2		1,2
PEK_W03	K2ZIP_ZJ_W05, K2ZIP_ZJ_W06	C2		1,2
PEK_K01	K2ZIP_ZJ_K05, K2ZIP_ZJ_K06	C3		1,2
PEK_K02	K2ZIP_ZJ_K05, K2ZIP_ZJ_K06	C3		1,2

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Strategia Six Sigma**

Name in English: **Six Sigma strategy**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Quality Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041310**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15			30	
Number of hours of total student workload (CNPS)	30			30	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	1			1	
including number of ECTS points for practical (P) classes				1	
including number of ECTS points for direct teacher-student contact (BK) classes	0.6			0.7	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

**I. Relating to knowledge:**

**II. Relating to skills:**

**III. Relating to social competences:**

PROGRAMME CONTENT		
Form of classes – Lecture		Number of hours
Lec1		2
Lec2		2
Lec3		2
Lec4		2
Lec5		2
Lec6		2
Lec7		2
		Total hours: 14
Form of classes – Classes		Number of hours
CI1		2
CI2		2
CI3		2
CI4		2
CI5		2
CI6		2
		Total hours: 12
Form of classes – Project		Number of hours
Proj1		2
Proj2		2
Proj3		2
Proj4		2
Proj5		2
Proj6		2
Proj7		2
		Total hours: 14

TEACHING TOOLS USED
N1. problem exercises
N2. traditional lecture with the use of transparencies and slides
N3. self study - preparation for project class
N4. project presentation
N5. problem discussion

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	
P =		

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Classes)

Evaluation (F – forming (during semester), P – concluding (at semester end))	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01 - PEK_U03, PEK_K01 - PEK_K02	
P =		

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_U03 PEK_K01 - PEK_K02	
P =		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Six Sigma strategy**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_ZJ_W01, K2ZIP_ZJ_W02	C1		2
PEK_U01, PEK_U02, PEK_U03	K2ZIP_ZJ_U01, K2ZIP_ZJ_U02	C1, C2, C3		1,3,4,5
PEK_K01, PEK_K02	K2ZIP_ZJ_K01, K2ZIP_ZJ_K02	C4		1,3,4,5

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Seminarium dyplomowe**

Name in English:

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Quality Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041315**

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)					30
Form of crediting					Crediting with grade
Group of courses					
Number of ECTS points					1
including number of ECTS points for practical (P) classes					1
including number of ECTS points for direct teacher-student contact (BK) classes					

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

**I. Relating to knowledge:**

**II. Relating to skills:**

**III. Relating to social competences:**

PROGRAMME CONTENT



Form of classes – Seminar		Number of hours
Sem1		2
Sem2		2
Sem3		2
Sem4		24
		Total hours: 30

TEACHING TOOLS USED
N1. multimedia presentation N2. tutorials N3. problem discussion

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Seminar)		
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	
F2	PEK_K01, PEK_K02, PEK_K03	
P = P=0,8*F1+0,2*F2		

PRIMARY AND SECONDARY LITERATURE
<u>PRIMARY LITERATURE</u>
<u>SECONDARY LITERATURE</u>

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY <b>Management and Manufacturing Engineering</b>				
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_U, PEK_K	K2ZIP_K01, K2ZIP_K05, K2ZIP_U10, K2ZIP_U11, K2ZIP_U14	C1, C2, C3		N1, N2, N3
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SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **PRACA DYPLOMOWA I, II**

Name in English:

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Quality Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041351, ZPM041352**

Group of courses: **no**

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

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

**I. Relating to knowledge:**

**II. Relating to skills:**

**III. Relating to social competences:**

PROGRAMME CONTENT

TEACHING TOOLS USED

- N1. case study
- N2. tutorials
- N3. self study - self studies and preparation for examination

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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_U, PEK_K	K2ZIP_K04, K2ZIP_U12, K2ZIP_U14			

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Badania operacyjne**

Name in English: **Operations research**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Production Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041401**

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)	90				
Form of crediting	Crediting with grade				
Group of courses					
Number of ECTS points	3				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes					

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

1. Knowledge of the issues presented in the courses "Mathematical Analysis", "Algebra and Analytic Geometry" and "Engineering Statistics".

### SUBJECT OBJECTIVES

C1. Students should obtain basic knowledge from the linear programming and the game theory, taking into account the aspects of their application.

C2. Participants learn to formulate optimization problems in the field of management, transport services market, location of distribution and construction, technology, and systems designing. They also acquire the ability to formulate optimization problems from queuing theory.

C3. Participants obtain and consolidate social skills including emotional intelligence involving the ability to work in a group of students to solve problems effectively with regard to accountability, integrity and fairness in the proceedings

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Student has a basic knowledge of linear programming methods and methods supporting optimal decision taking. He knows the basics of linear programming, the simplex algorithm, can construct the dual model, knows methods of sensitivity analysis of the optimal solution. He has knowledge of basic programming and discrete algorithms, knows the basic algorithms for solving balanced transportation problem, the basics of formulating and solving problems related to minimizing empty runs, knows the basics of graph theory and can apply them to solve the issues related to project management. He knows the basic concepts of the game theory.

### II. Relating to skills:

### III. Relating to social competences:

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Operations research as a tool to support decision-making processes - classification decision-making processes. Methods of decision making under conditions of certainty. Linear programming (PL) - linear model of decision-making, decisions acceptable and optimal. Graphical methods of PL problem solving. Training the discussed material.	2
Lec2	Linear programming models. Formulation and solution of problems PL - interpretation of the results. Simplex algorithm. Training the discussed material.	2
Lec3	Duality in linear programming. Matrix calculus in solving tasks of PL. The dual problem, its measurement and interpretation. Sensitivity analysis of the optimum solution. Changes in the parameters of the objective function and the free terms of constraints. Addition or removing decision variables. Comprehensive analysis of the optimal solution.	2
Lec4	Integer Linear Programming (discrete). The method of shutoff surfaces.	2
Lec5	Classical transportation models and algorithms. Transportation model with the criterion of time. Transportation model (unbalanced, with limited bandwidth routes). The problem of localization of production.	2
Lec6	Examples of problems, which may be reduced to the transportation problem (issue of optimal allocation). The tasks of transport, production and transport and warehousing. Minimizing empty runs. Blocking the route. The multi-stage transportation problem.	2
Lec7	Introduction to graph theory. Project management (network programming). The maximum flow in a network. Ford-Fulkerson algorithm. Decision trees. Minimum spanning tree. The shortest routes in the graph.	2
Lec8	Network Models - deterministic (CPM, PERT) and stochastic (GERT). Time and cost analysis. Gantt charts. Resource optimization in network. Salesman Problem. Little's algorithm. The knapsack problem. The production and inventory models.	2
Lec9	Multi-criteria optimization. Selection of nonlinear decision models solvable with PL methods.	2

Lec10	Introduction and examples of games (multiplayer, double zero-sum, multi-stage, random). Basic concepts (pure strategy, mixed, payment, the value of the game).	2
Lec11	Matrix games - mixed strategies, expected value criterion, graphical method for solving games $2 \times n$ . John von Neumann's theorem on the existence of solutions for each game matrix. Training the discussed material.	2
Lec12	Examples of the use of mixed strategies: fishing in Jamaica, playing "the guerrillas and the police." Tree - a character-developed game. Solving game with method "pruning the tree" (backwards induction).	2
Lec13	Games against nature. Criteria for finding the optimal decision: Laplace, the Bayesian Hurwicz and Savage's.	2
Lec14	Double games with non-zero sum: Nash equilibrium, Pareto optimality, safe and contsafe strategies. Nash arbitration scheme and cooperative solutions. Employer-employee negotiations.	2
Lec15	Final test.	2
		Total hours: 30

TEACHING TOOLS USED	
N1. traditional lecture with the use of transparencies and slides	
N2. problem discussion	

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	test, oral answer
P = F1		

PRIMARY AND SECONDARY LITERATURE
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#### PRIMARY LITERATURE

[1] Ignasiak E. (red.): Badania operacyjne. Warszawa 2001, PWE[2] Kukuła K. (red.): Badania operacyjne w przykładach i zadaniach. Warszawa 2002, PWN[3] Trzaskalik T.: Wprowadzenie do badań operacyjnych z komputerem. Warszawa 2008, PWE[4] Straffin P.: Teoria gier, 2001, Scholar[5] Malawski M., Wieczorek A., Sosnowska H. (2004): Konkurencjai kooperacja. Teoria gier w ekonomii i naukach społecznych, 2004, PWN.

#### SECONDARY LITERATURE

[1] Stadnicki J.: Teoria i praktyka rozwiązywania zadań optymalizacji z przykładami zastosowań technicznych. Warszawa 2006, WNT[2] Szapiro T. (red.): Decyzje menadżerskie z Excelem. Warszawa 2000, PWE[3] Guzik B.: Ekonometria i badania operacyjne. Wydawnictwo AE Poznań, Poznań 1999[4] Krawczyk S.: Badania operacyjne dla menadżerów. Wydawnictwo AE Wrocław 1996[5] Lipiec-Zajchowska M. (red.): Wspomaganie procesów decyzyjnych. Tom III. Badania operacyjne. Wydawnictwo C.H. Beck, Warszawa 2003[6] Anholcer M., Gaspras H., Owczarkowski A.: Przykłady i zadania z badań operacyjnych i ekonometrii. Wydawnictwo AE Poznań, Poznań 2003[7]. Watson J.: Strategia: Wprowadzenie do teorii gier, 2005, Norton, New York.[8] Gibbons R.: Game Theory for Applied Economists, 1992 Princeton U.P.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Operations research**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_W01, K2ZIP_W02	C1, C2, C3	Le.1-Le.15	N1, N2

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Metody kształtowania wybranych cech produktów**

Name in English: **Methods for forming of the selected products features**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Production Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041402**

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)	30				
Form of crediting	Crediting with grade				
Group of courses					
Number of ECTS points	1				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	0.6				

## PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student has a basic knowledge of manufacturing technologies, machining methods, the basic properties of the materials
2. Student has basic skills in the selection of materials and manufacturing processes
3. student has abilities of analyzing and synthesis of information

## SUBJECT OBJECTIVES

- C1. Acquiring knowledge about phenomena affecting the using wear of products. Learning about the surface engineering methods shaping functional, technological and operational properties of products.
- C2. Acquisition of skills of understanding the links between the characteristics of the material and geometric properties of the surface layers and consumables products. Acquisition of skills for choosing surface engineering methods for forming selected features of the products
- C3. The acquisition and consolidation of social skills include: team working abilities, responsible, accountable use of engineering knowledge

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Enumerates and briefly characterises the basic phenomena that affect the using wear of products.

Explains the basic terms of surface engineering.

PEK\_W02 - Characterises basic properties of surface layers and explains their effect on the usable characteristics of the products.

PEK\_W03 - Explains the implementation mechanisms of surface treatment processes. Enumerates and characterises the basic groups of the processes forming of usable characteristics of the surface layers.

### II. Relating to skills:

### III. Relating to social competences:

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction to the course topics. Rules of the course.	2
Lec2	Preview of the external factors (work conditions) influences on the products	2
Lec3	Introduction to the surface engineering methods	2
Lec4	Features of the products formed by surface engineering methods	2
Lec5	Manufacturing processes for modifying of the properties superficial layers of the Fe alloys	2
Lec6	Manufacturing processes for modifying of the properties superficial layers of the non-ferrous alloys	2
Lec7	Laser processing methods of the superficial layers	2
Lec8	Chemical and electro – chemical coating methods	2
Lec9	Thermal spray coating processes	2
Lec10	CVD & PVD coating processes	2
Lec11	Surface engineering methods in the new product development	2
Lec12	Economical issues of the implementation surface engineering methods	2
Lec13	Surface engineering methods in manufacturing: case study	2
Lec14	Surface engineering methods in manufacturing: case study	2
Lec15	Final test	2
		Total hours: 30

## TEACHING TOOLS USED

- N1. informative lecture
- N2. problem lecture
- N3. tutorials
- N4. case study
- N5. problem discussion

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	colloquium
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

F.W.Bach, K.Mohwid, A.Laarmann, T.Wenz: Modern Surface Technology, Willey, 2006  
M. Cartier: Handbook of surface treatment and coatings, Professional Engineering Publishing, 2003  
A guide to surface engineering terminology, Institute of Materials in association with the IFHT, 1995.

SECONDARY LITERATURE

E.Kannatey-Asibu: Principles of laser material processing, Willey, 2009  
R.B. Heinmann: Plasma spray coating, Willey 2008  
Surface engineering for corrosion and wear resistance, Materials Park, OH: ASM International: Institute of Materials, 2001.  
Surface and Coatings Technology, Elsevier, 2000  
Surface Engineering, Maney Publishing, 2003

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Methods for forming of the selected products features**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_PM_W06, K2ZIP_W04	C1, C2, C3	Lec1 - Lec15	N1, N2, N3, N4, N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Utrzymanie ruchu maszyn i urządzeń**

Name in English: **Operation maintenance of machines and devices**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Production Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041403**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30			15	
Number of hours of total student workload (CNPS)	60			30	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	2			1	
including number of ECTS points for practical (P) classes				1	
including number of ECTS points for direct teacher-student contact (BK) classes	1.2				

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

1. It has a basic knowledge of the structure and operation of components and assemblies as well as the principles of selection and construction.
2. It has a well-established knowledge of basic techniques.
3. It has a well-established expertise in construction and machine control rules.

### SUBJECT OBJECTIVES

- C1. Understanding the basic principles of the concept of Total Productive maintenance (TPM).
- C2. Understanding the basic tools of TPM and methods to increase the efficiency of maintenance of the machinery. Understanding the principles of determining indicators of progress in the implementation of TPM methodology.
- C3. Learning capabilities of computer systems of the CMMS class supporting scheduling service and repair tasks, inventory management and servicing and repair personnel management.

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Knows the range of activities and principles of choice of strategy of maintenance of manufacturing machinery and equipment.

PEK\_W02 - Knows the basic tools and indicators TPM.

PEK\_W03 - He knows the basic features and capabilities of computer systems of the CMMS class supporting scheduling service and repair tasks, inventory management and servicing and repair personnel management.

### II. Relating to skills:

PEK\_U01 - He can use the acquired knowledge to formulate tasks to improve the system of maintenance of manufacturing machinery and equipment.

PEK\_U02 - Is able to determine the indicators covering the progress in the implementation of TPM methodology.

PEK\_U03 - Can use modern IT tools for computerized management of maintenance processes.

### III. Relating to social competences:

PEK\_K01 - Can search and use the recommended literature for the course and independently acquire knowledge.

PEK\_K02 - He can take advantage of modern IT tools.

PEK\_K03 - Understands the need for regular and independent work on the mastery of the course material.

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	The main issues related to maintenance of manufacturing machinery and equipment: performance requirements, the analysis of cause-and-effect machine failure, the role and importance (benefits) of the organization and planning of maintenance	4
Lec2	History and development of the concept of TPM, characteristics of basic pillars of TPM	2
Lec3	Characteristics of the main tools in the field of TPM - examples of their use	4
Lec4	Maintenance strategies - the idea of a systematic and systemic approach to the problem of maintenance	2
Lec5	Measures and indicators determining the effectiveness of the implementation of the TPM methodology	2
Lec6	IT systems of CMMS class, maintenance management support (requirements and functions of selected systems, the selection criteria of the system)	4
Lec7	Implementation of TPM methodology into industrial practice (role of Maintenance and its organization)	2
Lec8	Examples of solutions for the implementation of the TPM	8
Lec9	Test	2
		Total hours: 30
Form of classes – Project		Number of hours
Proj1	Introduction. Presentation of selected modules of the CMMS	3
Proj2	Spare Parts Management. The part card. Warehouse Management. The structure of the module and generated documents	2

Proj3	Fulfilling orders for maintenance. Generating demand for materials and spare parts	2
Proj4	Management of personell that fulfills maintenance activities. Reports from the workload. Planning service orders. The stages and the necessary data. Building schedules for maintenance execution	4
Proj5	Reporting of orders completion. Cost analysis: planned and actual costs. Reports for maintenance indicators	2
Proj6	Test	2
		Total hours: 15

TEACHING TOOLS USED	
N1. traditional lecture with the use of transparencies and slides	
N2. self study - preparation for project class	

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	Test
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_U01, PEK_U02, PEK_U03 PEK_K01, PEK_K02, PEK_K03	Project defense
P = F1		

PRIMARY AND SECONDARY LITERATURE	
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#### PRIMARY LITERATURE

1. Legutko S.: Podstawy eksploatacji maszyn i urządzeń. Wyd. WSiP. Warszawa, 2007.
2. Słowiński B.: Inżynieria eksploatacji maszyn. Wyd. Pol. Koszalińskiej. Koszalin, 2011.
3. Kaźmierczak J.: Eksploatacja systemów technicznych. Wyd. Pol. Śląskiej. Gliwice, 2000.

#### SECONDARY LITERATURE

1. Hebda M.: Elementy teorii eksploatacji systemów technicznych. Wyd. MCNEMT. Radom, 1990.
2. Żółtowski B.: Podstawy diagnostyki maszyn. Wyd. ATR Bydgoszcz. Bydgoszcz, 1996.
3. Honczarenko J.: Elastyczna automatyzacja wytwarzania. Obrabiarki i systemy obróbkowe. WNT Warszawa, 2000.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Operation maintenance of machines and devices**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_PM_W05	C1 - C3	Lect1 - Lect8	N1, N2
PEK_U01, PEK_U02, PEK_U03	K2ZIP_PM_U09	C1 - C3	Pr1 - Pr5	N2
PEK_K01, PEK_K02, PEK_K03	K2ZIP_K02	C1 - C3	Lect1 - Lect8, Pr1 - Pr5	N1, N2

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Metody i techniki eksperymentu**

Name in English: **Methods and techniques of experiments**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Production Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041404**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30			15	
Number of hours of total student workload (CNPS)	60			60	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	2			2	
including number of ECTS points for practical (P) classes				2	
including number of ECTS points for direct teacher-student contact (BK) classes	1.2			1.4	

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

1. Basic knowledge of statistics, mathematical analysis and linear algebra

### SUBJECT OBJECTIVES

- C1. Explain the purpose of carrying out experiments
- C2. Explain the methods and techniques to carry out the experiment
- C3. Explain the types and purposes of tools to carry out the experiment

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Able to define the purpose and effect of the proposed experiment

PEK\_W02 - Able to propose and define a plan of the experiment

PEK\_W03 - Knows the concept and objectives of the experiment

### II. Relating to skills:

PEK\_U01 - Can collect data for the experiment

PEK\_U02 - Can process the data of the experiment

PEK\_U03 - Able to design an experiment

### III. Relating to social competences:

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction, concept experiment	2
Lec2	The differences between the method and technique	2
Lec3	Basic experiment Part 1	2
Lec4	Basic experiment Part 2	2
Lec5	Measurement	2
Lec6	Statistical tools	2
Lec7	Quality Tools	2
Lec8	Optimization Tools	2
Lec9	Factorial / multifactorial experiment	2
Lec10	DoE	2
Lec11	Methods for optimization of technological processes Part 1	2
Lec12	Methods for optimization of technological processes Part 2	2
Lec13	Case Study Part 1	2
Lec14	Case Study Part 2	2
Lec15	Summary, examination	2
		Total hours: 30
Form of classes – Project		Number of hours
Proj1	Introduction, health and safety regulations	2
Proj2	Discussion of proposed projects	2
Proj3	Choice of the experiment	2
Proj4	Data processing Part 1	2
Proj5	Data processing Part 2	2
Proj6	Verification and Optimization	2
Proj7	Summary, projects checking	2

Proj8	Examination	2
		Total hours: 16

TEACHING TOOLS USED		
N1. traditional lecture with the use of transparencies and slides		
N2. informative lecture		
N3. case study		
N4. self study - preparation for project class		

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	test
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_U01, PEK_U02, PEK_U03	project / test
P = F1		

PRIMARY AND SECONDARY LITERATURE		
<u>PRIMARY LITERATURE</u>		
Ewaryst Rafajłowicz "Optimization of the experiment with applications in monitoring the quality of production"		
Publishing Wrocław University of Technology		
Mieczysław Korzyński "Methodology of the experiment" WNT		
<u>SECONDARY LITERATURE</u>		

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Methods and techniques of experiments**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_PM_W08	C1, C2, C3	Lec1-Lec15	N1, N2, N3
PEK_U01, PEK_U02, PEK_U03	K2ZIP_PM_U08	C1, C2, C3	Proj1-Proj7	N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Planowanie technologiczne CAD/CAM**

Name in English: **Technology planning CAD/CAM**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Production Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041405**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15			15	
Number of hours of total student workload (CNPS)	60			60	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	2			2	
including number of ECTS points for practical (P) classes				2	
including number of ECTS points for direct teacher-student contact (BK) classes	1.2				

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

1. Fundamentals of geometric modeling and CAD systems.
2. Fundamentals of technology planning.
3. Basic knowledge about numerically controlled machine tools.

### SUBJECT OBJECTIVES

- C1. Gaining knowledge in the field of technology design for CNC machine tools using CAD/CAM systems.
- C2. Presentation of modern tools supporting manufacturing.
- C3. Discussion of issues related to project management in the field of structural design and technology.
- C4. Discussion of issues of selection, implementation and integration of CAD/CAM systems.

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Knowledge about existing solutions supporting structural design and technology.

PEK\_W02 - Ordered knowledge of technological design in CAM systems.

PEK\_W03 - Knowledge regarding the selection, integration and implementation of CAD/CAM systems in enterprises.

### II. Relating to skills:

PEK\_U01 - Student should be able to analyze parts taking into account that will be manufactured on CNC machine tools. Analysis of the structure manufacturability.

PEK\_U02 - Student should be able to prepare geometric data necessary to carry out project work.

PEK\_U03 - Student should be able to prepare a technological process for CNC machine tools using selected CAD/CAM systems.

### III. Relating to social competences:

PEK\_K01 - Ability to work in a design team.

PEK\_K02 - Ability to critically evaluate the results and their impact on the functioning of the company.

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction to CAD/CAM. A review of available solutions.	2
Lec2	Integration of CAD/CAM systems.	2
Lec3	Project management in an environment of CAD/CAM system. Relationship between documents. Generating the documentation.	2
Lec4	Technological design in CAM systems. The steps and tasks performed.	2
Lec5	Technological design in CAM systems. Functions of CAM.	2
Lec6	Presentation of selected machining strategy.	2
Lec7	Processes verification through computer simulation.	2
Lec8	Final test.	1
		Total hours: 15
Form of classes – Project		Number of hours
Proj1	Presentation of the selected environment of CAD/CAM system.	2
Proj2	Preparation of geometric data. Developing a plan of treatment for the sample.	4
Proj3	Generating tool paths for machining. Machining simulation. Management of the project.	4
Proj4	Generating technical documentation. NC code generation.	2
Proj5	Applying the FBM method to technology design for milled parts.	2
Proj6	Receive and evaluation of projects.	1
		Total hours: 15

## TEACHING TOOLS USED

- N1. traditional lecture with the use of transparencies and slides
- N2. multimedia presentation
- N3. problem discussion
- N4. self study - preparation for project class
- 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_W02, PEK_W03,	final test
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_U01, PEK_U02, PEK_U03	Evaluation of a project
P = F1		

## PRIMARY AND SECONDARY LITERATURE

### PRIMARY LITERATURE

- 1.Kief, Hans B.: FFS-Handbuch : Einfuhrung in flexible Fertigungssysteme und deren Komponenten : CNC, DNC, CAD, CAM, FFS, FMS, CAQ, CIM. 1998 r.
- 2.Kief, Hans B.: NC/CNC handbuch 2007/08 : CNC, DNC, CAD, CAM, CIM, FFS, SPS, RPD, LAN, NC-Maschinen, NC-Roboter, Antriebe, Simulation, Fach- und Stichwortverzeichnis . 2007r.
- 3.Singh, D. K.: Fundamentals of manufacturing engineering. 2008r.

### SECONDARY LITERATURE

- 1.Kief, Hans B.: FFS-Handbuch : Einfuhrung in flexible Fertigungssysteme und deren Komponenten : CNC, DNC, CAD, CAM, FFS, FMS, CAQ, CIM. 1998 r.
- 2.Kief, Hans B.: NC/CNC handbuch 2007/08 : CNC, DNC, CAD, CAM, CIM, FFS, SPS, RPD, LAN, NC-Maschinen, NC-Roboter, Antriebe, Simulation, Fach- und Stichwortverzeichnis . 2007r.
- 3.Singh, D. K.: Fundamentals of manufacturing engineering. 2008r.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Technology planning CAD/CAM**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_PM_W04	C1, C3, C4	Lec1, Lec2, Lec3, Lec4, Lec5, Lec6, Lec7	N1, N2, N5
PEK_U01, PEK_U02, PEK_U03	K2ZIP_PM_U04, K2ZIP_PM_U05	C2, C3	Proj1, Proj2, Proj3, Proj4, Proj5	N2, N3, N4, N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Zarządzanie strategiczne**

Name in English: **Strategic management**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Production Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041407**

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)	90				
Form of crediting	Examination				
Group of courses					
Number of ECTS points	3				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	1.8				

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

1. Knowledge of macro- and microeconomics.
2. Basic knowledge of management and marketing industrial establishment.
3. Knowledge of the extent and basic skills in costing for engineers and financial grounds.

### SUBJECT OBJECTIVES

- C1. To acquaint students with the management company from the perspective of top management or owner.
- C2. Presentation of basic problems associated with the activities of development and the bankruptcy of the company.
- C3. Getting to know the essence of the mission, vision and identity of the organization (company).
- C4. Getting to know the appropriate methods and techniques enabling analysis of the state and prospects for development.
- C5. Presentation of the problems of planning and strategic decision making - methods, tools, techniques.

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - He has knowledge about the nature and concept of strategic management, in particular strategic analysis of the company and possible models of corporate strategy.

PEK\_W02 - It has a general knowledge of the parameters and application of standards to identify and analyze the situation of the company.

PEK\_W03 - Understand the relationships and dependencies between the business environment and strategies implemented by the company.

### II. Relating to skills:

### III. Relating to social competences:

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	The genesis and essence of strategic management.	2
Lec2	Business concept. Concepts, functions and role of the mission.	2
Lec3	Business concept. Concepts, functions and role of the mission.	2
Lec4	Analysis of the environment closer - the sector.	2
Lec5	Analysis of the potential of strategic enterprises. Discussion of 4 methods.	2
Lec6	Analysis of the potential of strategic enterprises. Discussion of 4 methods.	2
Lec7	Taking into account technology portfolio analysis.	2
Lec8	The strategic goals.	2
Lec9	Strategies for diversification.	2
Lec10	Strategies for market development.	2
Lec11	The strategies of vertical integration.	2
Lec12	Competitive strategies.	2
Lec13	The presentation document production enterprise strategy development engineering industry.	2
Lec14	The identity of the company. Deployment and implementation strategies.	2
Lec15	Schools of strategic management.	2
		Total hours: 30

## TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides

N2. problem lecture

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	exam
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1.Romanowska M.: Planowanie strategiczne w przedsiębiorstwie. PWE Warszawa 2009.2.STRATEGOR. Zarządzanie firmą. Strategie. Struktury. Decyzje. Tożsamość. PWE Warszawa 1995.3.Steinmann H.G., Schreyogg G.: Zarządzanie – podstawy kierowania przedsiębiorstwem. Koncepcje, funkcje, przykłady. Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2001.4.Porter M.: Strategia konkurencji – metody analizy sektorów i konkurentów. PWE Warszawa 1999.5.Moszkowicz M. (red.): Zarządzanie strategiczne – systemowa koncepcja biznesu, PWE Warszawa 2005.

SECONDARY LITERATURE

1.Obłój K.: Strategia organizacji. PWE Warszawa 1998.2.Romanowska M., Gieszewska G.: Analiza strategiczna przedsiębiorstwa. PWE Warszawa 2009.3.Krupski R.: Zarządzanie strategiczne. Wyd. AE Wrocław 2003.4.Ansoff H.I.: Zarządzanie strategiczne. PWE Warszawa 1985.5.Drucker P.F.: Skuteczne zarządzanie. PWE Warszawa 1976.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Strategic management**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_W05, K2ZIP_W06	C1, C2, C3, C4, C5	Lec1 - Lec15	N1, N2

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Modelowanie procesów produkcyjnych**

Name in English: **Modelling of the production processes**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Production Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041408**

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			60	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	2			2	
including number of ECTS points for practical (P) classes				2	
including number of ECTS points for direct teacher-student contact (BK) classes	1.2			1.4	

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

1. Basic knowledge about the organization (production company) and its management principles.

### SUBJECT OBJECTIVES

- C1. The acquisition of knowledge and skills in the area of modeling of production systems using methods IDEF0 and UML.
- C2. The acquisition of knowledge and skills in the area of modeling of production systems using method BPMN.
- C3. The acquisition of knowledge and skills in the area of modeling of production systems using method VSM.

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - The student has a basic knowledge in the area of modeling of manufacturing systems.

PEK\_W02 - The student has an extended knowledge in the area of modeling of manufacturing systems using methods IDEF0, UML, BPMN and VSM.

### II. Relating to skills:

PEK\_U02 - Student is able to independently develop a model of the production system using the BPMN method (Business Process Model & Notation)

PEK\_U03 - Student is able to independently develop a model of the production system using the VSM method (Value Stream Mapping).

### III. Relating to social competences:

PEK\_K01 - Student is able to prepare and present the analysis of the results of the project

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Basic concepts. System - Process - Model	2
Lec2	IDEF0 method - part 1 - Description of the method	2
Lec3	IDEF0 method - part 2 - Tutorial	2
Lec4	UML method - part 1 - Use case diagram, Class diagram	2
Lec5	UML method - part 2 - Activity diagram, State Machine diagram, Time diagram	2
Lec6	UML method - part 3 - Tutorial	2
Lec7	BPMN method - part 1 - Description, Activities, Users - Business roles	2
Lec8	BPMN method - part 2 - Events, Gates	2
Lec9	BPMN method - part 3 - Tutorial	2
Lec10	VSM method - part 1 - Current state diagram	2
Lec11	VSM method - part 2 - Future state diagram	2
Lec12	VSM method - part 3 - Tutorial	2
Lec13	Other methods (Flowchart, Aris, Corporate Modeler etc.)	2
Lec14	Case studies	2
Lec15	End test	2
		Total hours: 30
Form of classes – Project		Number of hours
Proj1	- The organization of classes, - Discussion of the course, the presentation of the scoring system designs and conditions for end mark. - Presentation of schedules for each project, and an introduction to the topics	2
Proj2	Projekt 1a. Model of the system using IDEF0 method	6
Proj3	Projekt 1b. Model of the system using UML method	6

Proj4	Projekt 1c. Model of the system using BPMN method	6
Proj5	Projekt 1d. Model of the system using VSM method	6
Proj6	Summary. Presentation of the project results	4
		Total hours: 30

#### TEACHING TOOLS USED

- N1. self study - preparation for project class
- N2. report preparation
- N3. informative lecture
- N4. problem lecture
- N5. problem discussion

#### 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	End test
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_U01	Points for project 1a
F2	PEK_U01	Points for project 1b
F3	PEK_U02	Points for project 1c
F4	PEK_U03	Points for project 1d
F5	PEK_U01 + PEK_U02 + PEK_U03	Points for attendance
P = F1 + F2 + F3 + F4 + F5		

#### PRIMARY AND SECONDARY LITERATURE

#### PRIMARY LITERATURE

[1] „Integration definition for function modelling (IDEF0)”. Federal Information Processing Standards Publications, 21-grudz-1993.

[2] G. Booch, J. Rumbaugh, i I. Jacobson, UML - przewodnik użytkownika, Wyd. 2. Warszawa: Wydawnictwa Naukowo-Techniczne, 2002.

[3] S. Drejewicz, Zrozumieć BPMN modelowanie procesów biznesowych. Gliwice: Wydawnictwo Helion, 2012.

[4] M. Rother i J. Shook, Naucz się widzieć: Eliminacja marnotrawstwa poprzez mapowanie strumieni wartości, Wyd. 2, popr. Wrocław: Lean Enterprise Institute Polska, 2009.

#### SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Modelling of the production processes**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_W02, K2ZIP_W03	C1	Lec1-14	N3 - N5
PEK_U01	K2ZIP_U02, K2ZIP_U07, K2ZIP_U09	C1	pr1-6	N1 - N2
PEK_K01	K2ZIP_K05	C1	pr1-6	N1 - N2

#### SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Elastyczna automatyzacja wytwarzania**

Name in English: **Flexible manufacturing automation**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Production Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041411**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30			15	
Number of hours of total student workload (CNPS)	60			60	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	2			2	
including number of ECTS points for practical (P) classes				2	
including number of ECTS points for direct teacher-student contact (BK) classes	1.2				

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

1. The student has basic knowledge relating to the design-construction process, the structure, functioning and operation of the main machine elements and assemblies, and the principles of matching and constructing them.
2. The student has sound knowledge of the structure of machine tools and their functionalities.
3. The student can design the technological process of machining for a given workpiece, selecting proper machine tools and machining tools and parameters for a given production volume and capacity.

### SUBJECT OBJECTIVES

- C1. The student is to get to know the possibilities of flexible automating the different components of a manufacturing system.
- C2. The student is to acquire the skill of designing a flexible manufacturing system for a specified spectrum of workpieces.
- C3. The student is to configure a flexible manufacturing system for a specific spectrum of workpieces and to assess the different solutions.



## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - The student knows the structure of the flexible manufacturing system and can describe its main components.

PEK\_W02 - The student knows the functionalities of the manufacturing system and can propose different automation solutions for this system.

PEK\_W03 - The student can distinguish between the flow systems of workpieces, tools, machining fluids and chips and can select their configuration proper for the specific production conditions.

### II. Relating to skills:

PEK\_U01 - The student can analyze a spectrum of workpieces and design a functional flexible manufacturing system configuration.

PEK\_U02 - The student can select a proper system of the flow of tools and organize their circulation according to the technological tasks being carried out.

PEK\_U03 - The student can design a system of the flow workpieces, taking into account the manipulation, transport and storage of the material.

### III. Relating to social competences:

PEK\_K01 - The student understands the need for lifelong learning within the range of production management and engineering activity and improving her/his professional and social competences.

PEK\_K02 - The student is able to think and critically analyze the functioning of the production system in order to increase its effectiveness.

PEK\_K03 - The student is aware of responsibility for her/his own work and its impact on the functioning of the company.

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction, basic concepts of system theory, definitions of flexible manufacturing systems (FMS).	2
Lec2	Functional structure of a manufacturing system.	2
Lec3	The conditions for the development of the flexible automation of manufacturing.	2
Lec4	Realization conceptions of FMS.	2
Lec5	Machine Tools for FMS.	2
Lec6	Deburring methods and equipment in FMS.	2
Lec7	Coolants and chip disposal and part cleaning equipment in FMS.	2
Lec8	Tool management in FMS.	2
Lec9	Group technology and part family formation.	2
Lec10	Part handling systems in FMS.	2
Lec11	Automated material movement – transport systems in FMS.	2
Lec12	Storage systems in FMS.	2
Lec13	Information systems in FMS.	2
Lec14	The supervision and diagnosis of FMS operation.	2
Lec15	FMS availability.	2

		Total hours: 30
Form of classes – Project		Number of hours
Proj1	A preliminary presentation of planning process data of manufacturing system.	2
Proj2	Analysis of workpiece spectrum on the basis of production drawings and the definition of production parameters.	2
Proj3	The selection of a representative workpiece from the family of workpieces, the selection of operations and cuts, the selection of tools and machining parameters.	2
Proj4	The selection of FMS components for a group of workpieces.	2
Proj5	Getting acquainted with ProModel simulation systems.	2
Proj6	Data preparation and input into a simulation system.	2
Proj7	Performing simulation computations.	2
Proj8	An analysis of the results and drawing conclusions.	1
		Total hours: 15

TEACHING TOOLS USED		
<p>N1. traditional lecture with the use of transparencies and slides  N2. multimedia presentation  N3. self study - preparation for project class  N4. tutorials  N5. project presentation</p>		

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	colloquium
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_U01, PEK_U02, PEK_U03 PEK_K01, PEK_K02, PEK_K03	grading of project

## PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. Feld M.: Podstawy projektowania procesów technologicznych typowych części maszyn. WNT. 2000
2. Honczarenko J.: Elastyczna automatyzacja wytwarzania. WNT, Warszawa 2000
3. Krzyżanowski J.: Wprowadzenie do elastycznych systemów wytwórczych. Oficyna Wyd. PWr., Wrocław 2005

SECONDARY LITERATURE

1. Groover M.P.: Automation, Production Systems and Computer-Integrated Manufacturing. Third Edition. Prentice Hall International. London, 2008
2. Kief H.B.: FFS-Handbuch, Carl Hanser Verlag 1998
3. Luggen W.W.: Flexible manufacturing cells and systems, Prentice-Hall Int. Editions, 1991

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Flexible manufacturing automation**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_PM_W02, K2ZIP_W07	C1, C2	Lec1 - Lec15	N1, N2
PEK_U01, PEK_U02, PEK_U03	K2ZIP_PM_U02, K2ZIP_U07	C3	Proj1 - Proj8	N3, N4, N5
PEK_K01, PEK_K02, PEK_K03	K2ZIP_K01, K2ZIP_K03	C3	Proj1 - Proj8	N3, N4, N5

## SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Recykling materiałów**

Name in English: **Recycling of materials**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Production Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041412**

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					
including number of ECTS points for direct teacher-student contact (BK) classes	1.2				

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

1. The student has a basic knowledge of the properties of materials.

### SUBJECT OBJECTIVES

- C1. Acquisition of basic knowledge about the life cycle of the product and the disposal methods of the product. Acquisition of basic knowledge about recycling methods.
- C2. Understanding the need for waste management policy. Understanding the design and manufacture of the product in the context of environmental impact.
- C3. The acquisition and consolidation of social skills like responsibility, honesty, fairness in the procedure observance force in academia.

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Defining and understanding the issues of product life cycle.

PEK\_W02 - Identifying recycling methods.

PEK\_W03 - The presentation and characterization of waste management methods.

### II. Relating to skills:

### III. Relating to social competences:

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Organizational matters. The life cycle of the product. The problem of waste. European scale of the problem. The situation in Poland. Legislative considerations.	2
Lec2	General information about recycling. Balance of environmental burdens. Ekobilansu importance in the economy. Methods of waste disposal and waste products.	2
Lec3	Technical possibilities of identification and separation of materials.	2
Lec4	The problems of recycling polymeric materials. Classification of methods for recycling of polymeric materials. Methods for managing selected polymers as an example of recycling.	4
Lec5	Feedstock recycling for selected examples.	4
Lec6	Thermal recycling for selected examples.	4
Lec7	Recycling and characterization of materials in various industries. Recycling of packaging materials. Recycling of materials in the automotive industry. Recycling of waste electrical.	4
Lec8	Degradable materials as an alternative to recycling.	4
Lec9	Designing. Trends and prospects of recycling materials.	2
Lec10	Summary knowledge of recycling.	2
		Total hours: 30

## TEACHING TOOLS USED

N1. multimedia presentation

N2. tutorials

N3. traditional lecture with the use of transparencies and slides

N4. problem lecture

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 and oral test
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Plastics recycling in Europe, M. Kozłowski

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Recycling of materials**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_PM_W01	C1, C2, C3	Lec1-Lec10	N1, N2, N3, N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

### SUBJECT CARD

Name in Polish: **Mapowanie procesów w przedsiębiorstwie**

Name in English: **Enterprise processes mapping**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Production Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041413**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15			15	
Number of hours of total student workload (CNPS)	30			60	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	1			2	
including number of ECTS points for practical (P) classes				2	
including number of ECTS points for direct teacher-student contact (BK) classes	0.6				

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

1. Enhanced knowledge of the enterprise operation in terms of management and production.
2. The ability to obtain information from documents, databases and other sources, the ability to interpret information.

### SUBJECT OBJECTIVES

- C1. Acquisition of basic knowledge about analysis methods and business processes documentation.
- C2. Acquisition of skills how to use the basic tools used in the process mapping in production enterprises.
- C3. Acquisition of skills how to recognize the resources and information flow of across the enterprise.

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Student has knowledge about analysis methods and business processes documentation.

PEK\_W02 - Student can characterize resources and information flow in enterprise. He can describe their flow.

PEK\_W03 - Student can choose different tools and methods to analyze enterprise processes.

### II. Relating to skills:

PEK\_U01 - Student has the ability to use different tools of process mapping.

PEK\_U02 - Student can use computer aided tools in process modeling.

PEK\_U03 - Student can analyze models within compliance with the notation, accuracy and efficiency of modeling techniques.

### III. Relating to social competences:

PEK\_K01 - Student thinks and acts in a creative and enterprising way.

PEK\_K02 - Student is able to interact and work in a group, taking the different roles as a different functions in manufacturing and service enterprises.

PEK\_K03 - Student understands the need for continuous improvement of the organization, its processes and products.

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Presentation of basics of business processes mapping. Presentation of process definitions and basic information about process modeling. Presentation of basic ways of describing processes in enterprise.	2
Lec2	Presentation of process modeling using BPMN, discussion of basic concepts. Presentation of the scope of BPMN and its notation elements. Presentation how to create maps in BPMN. Presentation of the practical use of BPMN in enterprises.	4
Lec3	Presentation of process modeling using Value Stream Mapping (VSM), discussion of basic concepts. Presentation of the scope of VSM and its notation elements. Presentation how to create current state maps in VSM. Waste identification. Presentation how to create future state maps in VSM. Presentation of the practical use of VSM in enterprises.	4
Lec4	Presentation of process modeling using functional maps, discussion of basic concepts. Presentation of the scope of functional maps and its notation elements. Presentation how to create functional maps. Presentation of the practical use of functional maps in enterprises.	4
Lec5	Test	1
		Total hours: 15
Form of classes – Project		Number of hours
Proj1	Business processes mapping with BPMN notation	4
Proj2	Production processes mapping with VSM notation. Current and future state maps.	6
Proj3	Enterprise processes mapping with functional maps notation.	4



Proj4	Presentaion of project results in chosen company - project defensis.	1
		Total hours: 15

TEACHING TOOLS USED		
N1. case study		
N2. self study - preparation for project class		
N3. project presentation		
N4. traditional lecture with the use of transparencies and slides		

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	Colloquium
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_U01, PEK_U02, PEK_U03, PEK_K01, PEK_K02, PEK_K03	project presentation
P = F1		

PRIMARY AND SECONDARY LITERATURE		
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#### PRIMARY LITERATURE

1. Drejewicz S., „Zrozumieć BPMN modelowanie procesów biznesowych”, Helion, Gliwice 2012
2. Rother M., Shook J. „Naucz się widzieć. Eliminacja marnotrawstwa poprzez Mapowanie Strumienia Wartości”, WCTT Wrocław 2003 r.,
3. Rummler A. P., Brache A. P., „Podnoszenie efektywności organizacji”, PWE, Warszawa 2000 r.,

#### SECONDARY LITERATURE

1. Skrzypek E., Hofman M., "Zarządzanie procesami w przedsiębiorstwie : identyfikowanie, pomiar, usprawnianie", Wolters Kluwer Polska, Warszawa 2010

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Enterprise processes mapping**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_PM_W02, K2ZIP_W02, K2ZIP_W07	C1, C2, C3	Lec1, LEc2, Lec3, LEc4	N4
PEK_U01, PEK_U02, PEK_U03,	K2ZIP_PM_U03, K2ZIP_PM_U04, K2ZIP_U09	C1, C2, C3	Proj 1 - Proj 4	N1, N2, N3
PEK_K01, PEK_K02, PEK_K03	K2ZIP_PM_K01	C1, C2, C3	Proj 1 - Proj 4	N1, N2, N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Inżynieria odwrotna**

Name in English: **Reverse engineering**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Production Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041414**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15		15		
Number of hours of total student workload (CNPS)	30		30		
Form of crediting	Crediting with grade		Crediting with grade		
Group of courses					
Number of ECTS points	1		1		
including number of ECTS points for practical (P) classes			1		
including number of ECTS points for direct teacher-student contact (BK) classes	0.6				

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

1. Student has a basic knowledge of machine design and manufacturing technologies.
2. Student has a knowledge of Computer Aided Design (CAD).
3. Student has a knowledge of geometrical metrology.

### SUBJECT OBJECTIVES

- C1. Providing students with knowledge of application areas of reverse engineering.
- C2. Providing students with knowledge of methods of 3D scanning and reconstructions of 3D CAD models of physical objects.
- C3. Producing in students the ability of applying data from 3D scanning in the evaluation of the geometrical accuracy of products and in designing new products.

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Student is able to define reverse engineering and describe its basic applications.

PEK\_W02 - Student is able to characterize the process of reconstruction of the CAD model.

PEK\_W03 - Student is able to choose a 3D scanning method depending on the type of the object to be digitized.

### II. Relating to skills:

PEK\_U01 - Students can evaluate the data from 3D scanning and perform basic editing operations.

PEK\_U02 - Student can perform the process of comparison a model from 3D scanning with CAD data.

PEK\_U03 - Student is able to use data from a 3D scanner to design a new product.

### III. Relating to social competences:

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction. Application areas of reverse engineering.	2
Lec2	Contact methods of data acquisition . Technical and medical tomography.	2
Lec3	Optical methods of data acquisition.	2
Lec4	Basic methods of reconstructing of CAD models in reverse engineering.	2
Lec5	Advanced reconstruction methods. Assessment of accuracy in reverse engineering.	2
Lec6	Non-commercial 3D scanning systems - application areas, assessment of accuracy. Presentation of a selected device.	2
Lec7	Case study.	2
Lec8	Final test	1
		Total hours: 15
Form of classes – Laboratory		Number of hours
Lab1	Introduction. Presentation of 3D scanners. 3D scanning of a selected object.	2
Lab2	Learningh the program interface. Import and basic editing operations on3D scanning data.	2
Lab3	Orientation of models in space, best-fit function. Comparison of two models, and generating deviation maps.	2
Lab4	Advanced inspection functions.	2
Lab5	NURBS surface modeling - the basics.	4
Lab6	Integrating the CAD model with data from 3D scanning.	2
Lab7	Assessment	1
		Total hours: 15

## TEACHING TOOLS USED

- N1. multimedia presentation
- N2. traditional lecture with the use of transparencies and slides
- N3. case study
- N4. self study - preparation for laboratory class
- 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_W02, PEK_W03	final 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_U01, PEK_U02, PEK_U03	laboratory report

P = F1

## PRIMARY AND SECONDARY LITERATURE

### PRIMARY LITERATURE

- [1] Raja V., Fernandes K.J.: Reverse engineering: an industrial perspective, Springer, 2008, 242s.
- [2] Chlebus E.: Techniki komputerowe CAx w inżynierii produkcji, WNT, Warszawa 2000

### SECONDARY LITERATURE

- 1. E. Chlebus, B. Dytała, "Reverse engineering in technical and medical applications", Virtual design and automation - 1st VIDA International Conference, Poznań, 3-4 June 2004, 2005, str. 213-218
- 2. K. Oczos, I. Cena, "Rapid Inspection - metody pomiarowo-kontrolne adekwatne do rapid-technologii", Mechanik, 2008, No. 3, str. 165-176
- 3. J. Gawlik, K. Karbowski, "Metody odwzorowywania powierzchni w systemach inżynierii odwrotnej", Zeszyty Naukowe Politechniki Poznańskiej, Budowa Maszyn i Zarządzanie Produkcją, 2004, No. 1, str. 187-194

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Reverse engineering**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_W04	C1-C2	Lec1-Lec8	N1-N3, N5
PEK_U01, PEK_U02, PEK_U03	K2ZIP_PM_U03	C3	Lab1-Lab7	N4-N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Zarządzanie cyklem życia produktu**

Name in English: **Product Lifecycle Management**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Production Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041415**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30			15	
Number of hours of total student workload (CNPS)	60			60	
Form of crediting	Examination			Crediting with grade	
Group of courses					
Number of ECTS points	2			2	
including number of ECTS points for practical (P) classes				2	
including number of ECTS points for direct teacher-student contact (BK) classes	1.2				

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

1. knowledge of IT systems in the manufacturing
2. knowledge of the new product development process
3. knowledge, including practical CAD systems

### SUBJECT OBJECTIVES

- C1. The aim of the course is to provide knowledge about the principles and importance of product lifecycle management, ie from its inception until its disposal in manufacturing systems.
- C2. The aim of the course is to provide basic information about the methods and techniques of managed of the product life stages.
- C3. Will be presented and used the latest solutions that support the work of the product lifecycle management, including tools of the PLM family (Product Lifecycle Management).

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - knowledge of the role and function of PLM in the manufacturing

PEK\_W02 - knowledge of the role and functions of a PDM system in the manufacturing

PEK\_W03 - understanding of the importance of integration and process approach in the organization of the production system

### II. Relating to skills:

PEK\_U01 - ability to model a new product - design and technological documentation

PEK\_U02 - team management skills development

PEK\_U03 - ability of modeling workflows

### III. Relating to social competences:

PEK\_K01 - Think and act in a logical manner

PEK\_K02 - Can draw logical conclusions and resolve problem.

PEK\_K03 - Able to prioritize appropriately for implementation specified by you or other tasks.

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction to subject	2
Lec2	Managing product development - design	2
Lec3	IT systems in Product Development	2
Lec4	Product data management - project, BOM	2
Lec5	Product Lifecycle Management	2
Lec6	The importance of product lifecycle management	2
Lec7	Trends in Product Lifecycle Management	2
Lec8	Workflow management	2
Lec9	Managing product development - process planning	2
Lec10	Product Data Management - documents, classification	2
Lec11	Zarządzanie danymi produktu - integracja	2
Lec12	Product data management - changes	2
Lec13	Product Lifecycle Management - stages of life	2
Lec14	Standards in PDM / PLM	2
Lec15	PLM Market	2
		Total hours: 30
Form of classes – Project		Number of hours
Proj1	Students will develop a project using the PLM tool. They make modeling of the product, its structure and its manufacturing process. Selected business processes needed to produce the product will be modeled too. Process simulation will be conducted using tools for managing workflow.	15



## TEACHING TOOLS USED

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

## 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	Exam
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_U01, PEK_U02, PEK_U03 PEK_K01, PEK_K02, PEK_K03	project, report
P = F1		

## PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

script: Production Management, Mariusz Cholewa, PhD(Eng.)

SECONDARY LITERATURE

PDMA Handbook of New Product Development (2nd Edition); Edited by: Kahn, Kenneth B. © 2005 John Wiley & Sons

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Product Lifecycle Management**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_PM_W01	C1, C2	Lec1-Lec15	N1, N3, N4
PEK_U01, PEK_U02, PEK_U03	K2ZIP_PM_U01, K2ZIP_PM_U03, K2ZIP_PM_U04, K2ZIP_PM_U07	C3	Proj1	N1, N2, N5
PEK_K01, PEK_K02, PEK_K03	K2ZIP_K03, K2ZIP_PM_K01, K2ZIP_PM_K02	C1, C3	Proj1	N1, N2

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Symulacja procesów produkcyjnych**

Name in English: **The simulation of manufacturing processes**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Production Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041417**

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					

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

1. Knowledge of process planning

### SUBJECT OBJECTIVES

- C1. Introduction to with the problems design methods of simulation models of manufacturing systems
- C2. The acquisition of practical skills-building simulation models and analyzing their results
- C3. Understanding the issues of multi-criteria optimization of manufacturing systems

SUBJECT EDUCATIONAL EFFECTS

**I. Relating to knowledge:**

**II. Relating to skills:**

PEK\_U01 - Using the example simulation tool for manufacturing systems

PEK\_U02 - Using a sample tool to optimize production systems

PEK\_U03 - Building adequate, discrete simulation models for production systems

**III. Relating to social competences:**

PROGRAMME CONTENT

Form of classes – Project		Number of hours
Proj1	Building a deterministic simulation model of manufacturing system in order to determine the optimal frequency of deliveries	4
Proj2	Building a deterministic simulation model of manufacturing system in order to determine the optimal frequency of deliveries including hardening operations	2
Proj3	Building a deterministic simulation model of manufacturing system in order to determine the optimal frequency of delivery including quality control operations	2
Proj4	Building a deterministic simulation model of manufacturing system in order to determine the optimal frequency of deliveries at various production plan	4
Proj5	Building deterministic simulation model of manufacturing system to determine the optimum frequency of operation of supply assembly including	2
Proj6	Building a deterministic simulation model of manufacturing system in order to determine the optimal frequency of supply, taking into account the various modes of transport and the cost of	2
Proj7	Performing a test	2
Proj8	Building non-deterministic simulation model of manufacturing system	2
Proj9	Building a simulation model of the manufacturing system niedeterministycznego uwzględnieniem breaks and the use of macros	2
Proj10	Building non-deterministic simulation model of manufacturing system using variables and attributes	2
Proj11	Perform non-deterministic multi-criteria optimization of manufacturing systems	4
Proj12	Perform a test	2
		Total hours: 30

TEACHING TOOLS USED

N1. problem exercises

N2. case study

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	Defence project
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. Zdanowicz R.: Modelowanie i symulacja procesów wytwarzania, WPS, Gliwice 2002.
2. Chlebus E.: Techniki komputerowe CAx w inżynierii produkcji. PWT, Warszawa 2000

SECONDARY LITERATURE

1. A. Muhlemann, „Zarządzanie Produkcją. Usługi”, PWN 1997.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**The simulation of manufacturing processes**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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, PEK_U02, PEK_U03	K2ZIP_U02, K2ZIP_U03	C1, C2, C3	Pr1-Pr12	N1, N2

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

### SUBJECT CARD

Name in Polish: **Zintegrowane systemy zarządzania**

Name in English: **Integrated management systems**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Production Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041418**

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					

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

1. Knowledge of the design, characteristics and funkcjons of production systems
2. Knowledge of basic organizational criteria of manufacturing systems

### SUBJECT OBJECTIVES

- C1. The acquisition of skills in the design of information systems, with particular emphasis on the design flow of information and documentation in the manufacturing systems
- C2. Knowledge of design tools for information systems and the problems of implementation and customization of information systems to needs of enterprises
- C3. Understanding the role that information technology and information systems serve in the management of production systems

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

### II. Relating to skills:

PEK\_U01 - The acquisition of practical skills in the field of analysis and design of integrated information systems for industrial companies

PEK\_U02 - Able to model the flow of work and information in the various functional areas of business, able to integrate data from various functional areas of production companies to achieve production orders

PEK\_U03 - Able to develop documentation related to the production flow

### III. Relating to social competences:

PEK\_K01 - Able to think and critically analyze the operation of the manufacturing system for improve its effectiveness

PEK\_K02 - Able to interact and work in a group, taking the different organizational roles in manufacturing companies and service

PEK\_K03 - Understands the need for continuous improvement of the organization, its processes and products and the need for organizational change

## PROGRAMME CONTENT

Form of classes – Project		Number of hours
Proj1	Choice and an analysis of the selected subsystems of the production company	4
Proj2	Analysis of possibilities of integration of individual subsystems	4
Proj3	Analysis of information needs	4
Proj4	Development of models of workflow and information and in the individual functional areas using selected methods of modeling functions and processes	6
Proj5	Development of models of data and production documentation flow	6
Proj6	Analysis of individual data integration capabilities in the model from different functional areas to achieve an exemplary production orders	6
		Total hours: 30

## TEACHING TOOLS USED

N1. case study

N2. tutorials

N3. self study - preparation for project class

N4. problem discussion

## 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_U1, PEK_U2, PEK_U3	
F2	PEK_K1, PEK_K2, PEK_K3	
P = 0,9*F1+0,1*F2		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Integrated management systems**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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, PEK_U02, PEK_U03	K2ZIP_U08, K2ZIP_U09, K2ZIP_U10	C1, C2, C3		N1, N2, N3, N4
PEK_K1, PEK_K2, PEK_K3	K2ZIP_K04, K2ZIP_K05	C1, C2, C3		N1, N2, N3, N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Studium przypadku**

Name in English: **Case study**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Production Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041419**

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)	30				
Form of crediting	Crediting with grade				
Group of courses					
Number of ECTS points	1				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	0.6				

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

1. Has knowledge of scientific projects - research and industrial
2. Can prepare an offer in the form of research project proposal and research offer for the company

### SUBJECT OBJECTIVES

- C1. Explain the principle of scientific - research projects
- C2. Explain methods of scheduling and budgeting in research projects
- C3. Explain the principles of substantive implementation of research projects

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Able to define the purpose and effect of the proposed research topics

PEK\_W02 - Can suggest the mode of applying for project

PEK\_W03 - Can distinguish between basic research and applied research and development

### II. Relating to skills:

### III. Relating to social competences:

PEK\_K01 - Able to work in a team

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction	2
Lec2	Types of projects	2
Lec3	Application Form	2
Lec4	Basic Research Projects	2
Lec5	Research and Development Projects	2
Lec6	Industrial Research Projects	2
Lec7	Funding agencies	2
Lec8	Structural Funds	2
Lec9	Preparation of the draft	2
Lec10	Summary of the preliminarily - application part	2
Lec11	Research project (one executor) - a case study	2
Lec12	Research project (consortium) - a case study	2
Lec13	Research project - Structural Funds - a case study	2
Lec14	Summary	2
Lec15	Examination	2
		Total hours: 30

## TEACHING TOOLS USED

N1. case study

N2. tutorials

N3. multimedia presentation

N4. project presentation

N5. informative lecture

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, K01	test
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Project Management - Case Studies - Harold Kerzner, HELION publishing house

SECONDARY LITERATURE

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Case study**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_PM_W07, K2ZIP_W01	C1, C2, C3	Lec1-Lec15	N1, N2, N3, N4, N5
PEK_K01	K2ZIP_K03, K2ZIP_K05	C1, C2, C3	Lec1-Lec15	N1, N2, N3, N4, N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Przedsiębiorczość innowacyjna**

Name in English: **Innovative Entrepreneurship**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Production Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041421**

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)	30				
Form of crediting	Crediting with grade				
Group of courses					
Number of ECTS points	1				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	1.2				

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

1. General knowledge about the free market economy.
2. Ability to discuss and present one's opinion in terms of dealing with problems connected with the business idea implementation and assessment of its innovation potential.
3. Bachelor's degree and basic knowledge of finance (profit, loss, income, expenses, liquidity, balance, taxes).

### SUBJECT OBJECTIVES

- C1. To familiarize students with the phenomenon of entrepreneurship from the business process point of view that relates entrepreneurship and business.
- C2. To familiarize students with the modern understanding of innovative entrepreneurship, innovation sources and innovation organization management (integrating technological, market and organizational changes).
- C3. To familiarize students with the factors of success or factors of failure of the company, their measures and sources, finding funding sources innovative enterprises.

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Has knowledge of ways and methods of project management, organization, planning and evaluation work in the project, knows methods of technical and economical evaluation of the innovative enterprises.

PEK\_W02 - Knows methods and ways of how to assess opportunities and risks in the scope of innovative activity.

PEK\_W03 - Knows how to assess and verify entrepreneurial activities that are a way of entrepreneurship realization.

### II. Relating to skills:

#### III. Relating to social competences:

PEK\_K01 - Can search for information and analyze them critically.

PEK\_K02 - Acting in a creative and enterprising way can work in a team in the scope of the selection of strategies and tools to

solve problems related to entrepreneurship and innovation.

PEK\_K03 - Can objectively evaluate the arguments, rationally explain and justify their point of view in terms of entrepreneurial activities with the use of knowledge in the fields of innovation and business practices.

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Organizational issues. The core of innovative entrepreneurship. The development of entrepreneurship in Poland and abroad.	2
Lec2	The entrepreneur. His qualities and competences. Personality approach. Characteristics of entrepreneurs; entrepreneurial orientation, sources of the entrepreneurial motivation. Methods of the entrepreneurship completion.	2
Lec3	The entrepreneurial process. Opportunity recognition.	2
Lec4	Entrepreneurial strategy for innovations. The business model.	2
Lec5	Entrepreneurial marketing.	2
Lec6	Building the founding team.	2
Lec7	Managing for innovations. Innovation as a core business process.	2
Lec8	Innovation process model. Enabling effective search for innovations.	2
Lec9	Creating the innovative organization. Organizing business processes in order to focus them on innovations.	2
Lec10	Technological trajectories and new innovative firms. Benefits from innovations.	2
Lec11	Building a business plan.	2
Lec12	Legal & tax issues. Intellectual property and financing entrepreneurial ventures	2
Lec13	Entrepreneurial growth. Leadership.	2
Lec14	Corporate entrepreneurship.	2
Lec15	Test.	2
		Total hours: 30

TEACHING TOOLS USED

- N1. case study
- N2. traditional lecture with the use of transparencies and slides
- N3. problem lecture

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 test
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

- [1] Bessant J., Tidd J., *Managing Innovation*, 5th Edition, Wiley, 2013
- [2] Bessant J., Tidd J., *Innovation And Entrepreneurship*, Wiley, 2011
- [3] Bygrave W., Zacharakis A., *Entrepreneurship*, 2nd Edition, Wiley, 2011
- [4] Drucker P.F., *Innovation And Entrepreneurship*, HarperBusiness, 1993
- [5] Westhead P., Wright M., McElwee G., *Entrepreneurship. Perspectives And Cases*, Pearson Education Limited, 2011

SECONDARY LITERATURE

- [1] Aulet B., *Disciplined Entrepreneurship: 24 Steps to a Successful Startup*, Wiley, 2013
- [2] Gordon M.E., *Trump University Entrepreneurship 101: How To Turn Your Idea Into a Money Machine*, Wiley, 2009
- [3] Johnson K.D., *The Entrepreneur Mind: 100 Essential Beliefs, Characteristics, and Habits of Elite Entrepreneurs*, Johnson Media Inc., 2013
- [4] Bridge R., *You Can Do It Too: The 20 Essential Things Every Budding Entrepreneur Should Know*, Kogan Page, 2010
- [5] Gerber M.E., *Awakening the Entrepreneur Within: How Ordinary People Can Create Extraordinary Companies*, HarperBusiness, 2009

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Innovative Entrepreneurship**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_W01	C1, C2, C3	Wy1 - Wy15	N1, N2, N3
PEK_K01, PEK_K02, PEK_k03	K2ZIP_K03, K2ZIP_K05	C1, C2, C3	Wy1 - Wy15	N1, N2, N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Seminarium dyplomowe**

Name in English: **Diploma seminar**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Production Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041424**

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)					30
Form of crediting					Crediting with grade
Group of courses					
Number of ECTS points					1
including number of ECTS points for practical (P) classes					1
including number of ECTS points for direct teacher-student contact (BK) classes					

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

SUBJECT OBJECTIVES

SUBJECT EDUCATIONAL EFFECTS

**I. Relating to knowledge:**

**II. Relating to skills:**

**III. Relating to social competences:**

PROGRAMME CONTENT



Form of classes – Seminar		Number of hours
Sem1		2
Sem2		2
Sem3		2
Sem4		24
		Total hours: 30

TEACHING TOOLS USED
N1. multimedia presentation N2. tutorials N3. problem discussion

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT (Seminar)		
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	
F2	PEK_K01, PEK_K02, PEK_K03	
P = P=0,8*F1+0,2*F2		

PRIMARY AND SECONDARY LITERATURE
<u>PRIMARY LITERATURE</u>
<u>SECONDARY LITERATURE</u>

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT <b>Diploma seminar</b> AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY <b>Management and Manufacturing Engineering</b>				
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, PEK_U02, PEK_U03	K2ZIP_U10, K2ZIP_U11, K2ZIP_U14	C1, C2, C3		N1, N2, N3
PEK_K01, PEK_K02, PEK_K03	K2ZIP_K01, K2ZIP_K05	C1, C2, C3		N1, N2, N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

### SUBJECT CARD

Name in Polish: **Zarządzanie projektami i innowacjami**

Name in English: **Project and innovation management**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Production Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041425**

Group of courses: **no**

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

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

1. Basics knowledge of management and marketing
2. Knowledge of the techniques and methods in the area of production management and services
3. Skills in information technology

#### SUBJECT OBJECTIVES

- C1. To familiarize students with the objectives and concepts of project management and innovation
- C2. Way of presenting problems and procedures to be followed in the implementation of project tasks
- C3. Implementation to the appropriate software (eg MS Project)
- C4. Teamwork skills
- C5. Way of presentation of project tasks

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Has knowledge of the procedures and techniques of project management

PEK\_W02 - Understands the relationships and dependencies between the general objectives and sub-objectives of the project and the risks of the project

### II. Relating to skills:

PEK\_U01 - Has the ability to carry out simple and complex operations using the procedures and techniques of project management

PEK\_U02 - It has the ability to use the resources for the implementation of information technology and project management

### III. Relating to social competences:

PEK\_K01 - Is aware of the increasing importance of project management and innovation in solving technical problems, economic and social

PEK\_K02 - The gradual acquisition of competence to work under the direction of a team leader, in terms of competitiveness

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	The scope of the lecture, assessment and literature. Introduction.	2
Lec2	Factors causing the change and the need for the organization by the project. Definitions and objectives of characterizing the type of project tasks. Components (elements) of the project.	2
Lec3	Basic types of projects (internal and external). Measures of success of the project. Measures of success of the project. The structure of the project. The management and nine areas of project management competence	2
Lec4	Initiating the project. Determining the actual requirements for the design and purpose of the project. List the needs of the project, limitations of the feasibility, cost analysis and recommendations for the project. Outline of the project	2
Lec5	Planning for the project. The main and sub objectives of the project. Decomposition-pyramid du Pont. The scope, impact and limitations of the project. Definition of the approach and identify of required resources. Inventory and Evaluation of the people involved in the project. Critical success factors.	2
Lec6	Project control plans and creation of a structure analysis of the work. The communication plan. The control plan design changes. Quality management plan and a plan of supply. Plan completion. The approach to the structure analysis of the work. Determination of levels of supervision	2
Lec7	Development of the project plan details. The selection of the project team:. Estimating the cost and duration of the project. Gantt Chart. Network diagrams CPM and PERT. Determining the project schedule. The risk of the project. Alternative plans	2
Lec8	Software description eg: MS Project. Closing the project: project evaluation and report on the implementation of the project, conclusions and experience.	2

Lec9	Basic concepts related to the development of technology: knowledge, research, scientific discoveries, inventions, innovations, patents, utility and industrial models, deployment and transfer	2
Lec10	Methods to stimulate creativity and innovation. Methods and techniques for generating, collecting, analyzing and selecting solutions. Measures of Technical Strategy: the intensity of R & D, sales of new products. Lean Manufacturing	2
Lec11	Software R & D and innovation strategy company a) the evolution of the management of R & D, b) development of products and processes, c) the dynamics of the market and the R & D, d) R & D programs .	2
Lec12	Technology transfer and innovation: - Types of licenses, - Forms of transfer and acquisition of technology, - Marketing of innovative technologies and attitudes, - Managing the implementation and improvement, - Technology transfer as a matter of national	2
Lec13	Institutional and organizational forms of innovation: - Innovation Relay Centres IRC FEMIRC, - Incubators, - Technology transfer centers, - etc	2
Lec14	The standards and specifications. Product certification and accreditation of institutions. Requirements of the EU Directive	2
Lec15	Final exam	2
		Total hours: 30
Form of classes – Project		Number of hours
Proj1	Scope of the project, assessment. Create teams. Generating project topics	2
Proj2	Presentation topics by leaders (or other members of the group), including project initiation phase	2
Proj3	Discussion about the merits of the presented projects, corrections and additions	2
Proj4	The planning phase of the project. Main and sub-objectives, the impact of the project	2
Proj5	The organizational structure of the project- presentation and discussion. Project control plan.	2
Proj6	Cost analysis, end of project	2
Proj7	Presentation in front of students and teacher. Assessment of the project	3
		Total hours: 15

#### TEACHING TOOLS USED

- N1. informative lecture
- N2. problem lecture
- N3. self study - preparation for project class
- N4. project presentation

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	Colloquium
P = F1+F2		

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_K01, PEK_K02	Presentation and of the project
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Mingus N.: Zarządzanie projektami, Wyd. Helion, Gliwice 2002 ,  
 Kerzner H.: Advanced Project Management, edycja polska, Wyd. ONE PRESS, 2005,  
 Lowe P.: Zarządzanie technologią. Możliwości poznawcze i szanse. Wyd. Śląsk, Katowice 1999,  
 Dworczyk M. Szlaska R.: Zarządzanie innowacjami. Wpływ innowacji na wzrost konkurencyjności przedsiębiorstw. Oficyna Wyd. Politechniki Warszawskiej, 2001.

SECONDARY LITERATURE

Wilczewski S.: MS Project 2003 Zarządzanie projektami,  
 Burton c., Michael N.: Zarządzanie projektami, Wyd. ASTRUN, Wrocław 1999,  
 Kasprzak W. Pelc K.: Wyzwania technologiczne- prognozy i strategie. Wyd. Profesjonalnej Szkoły Biznesu, Kraków 1999,  
 Mazurkiewicz A.: Modelowanie transformacji wiedzy do praktyki w budowie i eksploatacji maszyn. Wyd. Inst. Technologii Eksploatacji, Radom- Poznań 1999.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Project and innovation management**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_PM_W07	C1, C2	lec1-lec13	N1, N2
PEK_U01, PEK_U02	K2ZIP_U01	C2, C3	Pr1-Pr6	N2, N3
PEK_K01, PEK_K02	K2ZIP_PM_K01, K2ZIP_PM_K02	C4, C5	Pr1-Pr7	N3, N4

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

### SUBJECT CARD

Name in Polish: **Fizykochemia zaawansowanych materiałów funkcjonalnych**

Name in English: **Physicochemistry of advanced functional materials**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Production Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041426**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15				15
Number of hours of total student workload (CNPS)	30				30
Form of crediting	Crediting with grade				Crediting with grade
Group of courses					
Number of ECTS points	1				1
including number of ECTS points for practical (P) classes					1
including number of ECTS points for direct teacher-student contact (BK) classes					

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

1. chemistry and physics on the first university level

#### SUBJECT OBJECTIVES

C1. Introduction with relationship of materials structure, properties and method of syntheses.

C2. Introduction with basic knowledge of nanotechnology and nanomaterials

C3. Providing opportunities for students to combine their knowledge of chemistry, ecology, physics, material science



## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - The student should have basic knowledge associated with functional ceramic, metallic, polymer and composites materials

PEK\_W02 - The student should have basic knowledge associated with possible applications of functional materials.

PEK\_W03 - The student should have basic knowledge associated with nanomaterials and their functionalization. Student knows prospective applications of nanomaterials.

### II. Relating to skills:

PEK\_U01 - The student should have a competence of using modern achievements of science in engineer practice especially in material selection for optoelectronics, biotechnology, construction, automotive industry, medical sciences

PEK\_U02 - The student should know basic nanotechnology and functional materials terms. The student can assess relationship between the type of material, its structure and properties.

PEK\_U03 - The student can characterize benefits of functional materials applications to world, economy, environment and society.

### III. Relating to social competences:

PEK\_K01 - Student can think and act in imaginative way. Student can search for information and analyse them

PEK\_K02 - Student obeys academic rules.

PEK\_K03 - Student can relate effects of industry with the environmental impact.

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Introduction with the functional materials.	2
Lec2	Nanotechnology and nanomaterials.	3
Lec3	Functional polymer materials.	2
Lec4	Functional metallic materials	2
Lec5	Functional ceramic materials	2
Lec6	Functional composite materials	2
Lec7	Qualifying class – test	2
		Total hours: 15
Form of classes – Seminar		Number of hours
Sem1	Structure and properties of engineering materials	2
Sem2	Structure and properties of nanomaterials	2
Sem3	Functional polymer materials.	3
Sem4	Functional metallic materials.	3
Sem5	Functional ceramic materials.	3
Sem6	Functional composite materials.	2
		Total hours: 15

### TEACHING TOOLS USED

- N1. traditional lecture with the use of transparencies and slides
- N2. multimedia presentation
- N3. tutorials
- N4. problem discussion

### 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 PEK_K01 - PEK_K03	test
P = F1		

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

Evaluation (F – forming (during semester), P – concluding (at semester end))	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_U01 - PEK_U03 PEK_K01 - PEK_K03	oral answers, discussions, activity
F2	PEK_U01 - PEK_U03 PEK_K01 - PEK_K03	presentation of demanded problem, an essay on selected problem
P = F1		

### PRIMARY AND SECONDARY LITERATURE

#### PRIMARY LITERATURE

Functional and smart materials [Dokument elektroniczny] : structural evolution and structure analysis / Z. L. Wang and Z. C. Kang.

Nanoengineering of structural, functional, and smart materials / ed. by Mark J. Schulz, Ajit D. Kelkar, and Mannur J. Sundaresan.

#### SECONDARY LITERATURE

web pages, lectures notes

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Physicochemistry of advanced functional materials**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_PM_W06, K2ZIP_PM_W07, K2ZIP_PM_W08, K2ZIP_W09	C1, C2, C3	Lec1-Lec6	N1, N2, N3, N4,
PEK_U01 , PEK_U02, PEK_U03	K2ZIP_PM_U08, K2ZIP_U15	C1, C2, C3	Sem1-Sem6	N1, N2, N3, N4,
PEK_K01, PEK_K02, PEK_K03	K2ZIP_K03	C1, C2, C3	Lec1-Lec6, Sem1-Sem6	N1, N2, N3, N4,

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Optimalizacja rozmieszczenia stanowisk roboczych**

Name in English: **Optimizing deployment of workstations**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Production Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041427**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15			15	
Number of hours of total student workload (CNPS)	30			60	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	1			2	
including number of ECTS points for practical (P) classes				2	
including number of ECTS points for direct teacher-student contact (BK) classes	0.6			1.4	

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

1. Basic knowledge of logistics and enterprise management
2. The ability to build simulation models for discrete manufacturing systems

### SUBJECT OBJECTIVES

- C1. Acquisition of knowledge about how to deploy workstations
- C2. Learn how to build a layout plans
- C3. Learn how to optimize the planned deployments of workstations

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - He has knowledge of the mathematical arrangement of workplaces

PEK\_W02 - He has knowledge of the technological conditions of the deployment of workstations

PEK\_W03 - He knows the basic techniques of simulation deployment of workstations

### II. Relating to skills:

PEK\_U01 - He can choose a variety of simulation tools to verify the layout plans

PEK\_U02 - Can apply various simulation tools to verify and optimize the layout plans

PEK\_U03 - The student is able to properly make the deployment plan workstations

### III. Relating to social competences:

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Methodological approaches in the design of the deployment of production cells	3
Lec2	Mathematical methods for designing the deployment of workstations	2
Lec3	Technical considerations taken into account when deploying workstations	4
Lec4	Verification of simulation methods proposed solutions	2
Lec5	Data collection for the project simulation	2
Lec6	Classification of forms of organization of production for manufacturing cells	2
		Total hours: 15
Form of classes – Project		Number of hours
Proj1	Determination of the coefficient $i_0$ to match the number of facilities for the production plan and the available production technology	2
Proj2	The selection of machinery from manufacturers' catalogs. Optimizing deployment of workstations by using a mathematical algorithm MST (Modified Spanning Tree Algorithm)	4
Proj3	Optimizing deployment of workstations by using a mathematical algorithm triangles Schmigalli	2
Proj4	Optimizing deployment of workstations by using a mathematical algorithm ROC (Rank Order Clustering)	2
Proj5	Develop deployment of workstations, taking into account technological conditions. A comparison of the above methods based on the calculated cost.	3
Proj6	Assessment of the project	2
		Total hours: 15

## TEACHING TOOLS USED

- N1. traditional lecture with the use of transparencies and slides
- N2. informative lecture
- N3. problem exercises
- N4. calculation exercises
- N5. case study

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	Test
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_U01, PEK_U02, PEK_U03	Assessment of the project
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. PROJEKTOWANIE ROZMIESZCZENIA STANOWISK ROBOCZYCH / STANISLAW LIS, KRZYSZTOF SANTAREK Warszawa : PWN, 1980.
2. Podstawowa problematyka projektowania stanowisk pracy / Teresa Musioł, Jarosław Grzesiek ; Wyższa Szkoła Ekonomii i Administracji w Bytomiu. Bytom : Wyższa Szkoła Ekonomii i Administracji, 2008.

SECONDARY LITERATURE

PROJEKTOWANIE STANOWISK I PROCESOW PRACY / KAROL RYPULAK. LUBLIN : POLITECHNIKA, 1981.

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Optimizing deployment of workstations**  
 AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_PM_W02, K2ZIP_W03, K2ZIP_W07	C1	Lec1 - Lec9	N1, N2
PEK_U01, PEK_U02, PEK_U03	K2ZIP_PM_U02, K2ZIP_U02, K2ZIP_U03, K2ZIP_U07	C2, C3	Pr1 - Pr6	N3, N4, N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Innowacyjne technologie mechaniczne**

Name in English: **Innovative mechanical technologies**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Production Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041428**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30		15	15	
Number of hours of total student workload (CNPS)	30		60	30	
Form of crediting	Crediting with grade		Crediting with grade	Crediting with grade	
Group of courses					
Number of ECTS points	1		2	1	
including number of ECTS points for practical (P) classes			2	1	
including number of ECTS points for direct teacher-student contact (BK) classes	1.2				

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

1. Student will be acquainted with modern methods of computer aided technologies supporting product development - those were the main subject of the course of Product Development Technologies during earlier studies
2. Issues of concept design, construction in 2D and 3D, especially computer modeling directed at different manufacturing technologies
3. Basic information on technologies of rapid prototyping as a verifying tool in virtual prototyping

### SUBJECT OBJECTIVES

- C1. Methods of manufacturing prototypes and prototype series. Additive Manufacturing Technologies. Rapid Prototyping
- C2. Rapid Prototyping of products made of polymers, metals and ceramics
- C3. Rapid Tooling
- C4. Rapid Manufacturing
- C5. Medical applications of additive manufacturing technologies



## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Student should recognize machines for rapid prototyping and characterize their basic usability features

PEK\_W02 - Student should know how to optimally select and propose appropriate rapid prototyping technology based on requirements for new products which are to be verified physically

### II. Relating to skills:

PEK\_U01 - Student should perform a product development process optimized for its physical verification and evaluation for function and quality

PEK\_U02 - Student should be able to propose construction assumptions for a new product and design using proper engineering tools, based on a chosen manufacturing technology

### III. Relating to social competences:

PEK\_K01 - Awareness of the role of a product engineer in the process of production planning and the need for responsibility and engagement in new product development in a company

PEK\_K02 - Awareness of legal and business aspects and effects of engineering activities in the area of new product development

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Types and applications of physical prototypes. Manufacturing methods.	2
Lec2	Technologies of Rapid Prototyping - concept models	2
Lec3	Technologies of Rapid Prototyping - functional models made of polymers	4
Lec4	Technologies of Rapid Prototyping - functional models made of metals	4
Lec5	Technologies of Rapid Tooling - classification	2
Lec6	Technologies of Rapid Tooling - manufacturing prototype series of polymers	2
Lec7	Technologies of Rapid Tooling - manufacturing prototype series of metals	2
Lec8	Practical examples of Rapid Prototyping and Tooling in the industry	2
Lec9	Rapid Manufacturing - applications	4
Lec10	Innovative mechanical technologies in medical applications	4
Lec11	Final test	2
		Total hours: 30
Form of classes – Laboratory		Number of hours
Lab1	Technologies of Rapid Prototyping - concept models	2
Lab2	Technologies of Rapid Prototyping - functional models made of polymers	3
Lab3	Technologies of Rapid Prototyping - functional models made of metals	2
Lab4	Technologies of Rapid Tooling - manufacturing prototype series of polymers	2
Lab5	Technologies of Rapid Tooling - manufacturing prototype series of metals	2
Lab6	Technologies of Rapid Manufacturing	2

Lab7	Innovative mechanical technologies in medical applications	2
		Total hours: 15
Form of classes – Project		Number of hours
Proj1	Development of design assumptions for example new products	3
Proj2	Analysis and functional evaluation of design concepts for new products	2
Proj3	Design and visualization of 3D concepts of new products	2
Proj4	Design and visualization of 3D constructions of new products	2
Proj5	Analysis and virtual verification of CAD design models of new products	2
Proj6	Manufacturing (example) physical models of prototypes of new products	2
Proj7	Physical verification, functional and quality evaluation of manufactured prototypes of new products	2
		Total hours: 15

TEACHING TOOLS USED		
<p>N1. informative lecture  N2. multimedia presentation  N3. self study - preparation for laboratory class  N4. self study - preparation for project class  N5. project presentation</p>		

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	Final 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_U01, PEK_U02	short test
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_U01, PEK_U02 PEK_K01, PEK_K02	Evaluation and defense of a developed project
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

1. E. Chlebus, "Techniki komputerowe CAx w inżynierii produkcji", WNT, Warszawa 2000
2. Z. Kacprzyk, "Komputerowe wspomaganie projektowania: podstawy i przykłady", Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2012

SECONDARY LITERATURE

E. Chlebus, T. Boratyński, B. Dybała, M. Frankiewicz, P. Kolinka, "Innowacyjne technologie Rapid Prototyping - Rapid Tooling w rozwoju produktu", Oficyna Wydawnicza PWR, Wrocław 2003

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Innovative mechanical technologies**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_W04	C1-C5	Lec1-Lec11	N1-N5
PEK_U01, PEK_U02	K2ZIP_U04	C1-C5	Proj1-Proj7, Lab1-La7	N1-N5
PEK_K01, PEK_K02	K2ZIP_K02	C1-C5	Lab1-Lab7	N1-N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Zarządzanie wiedzą**

Name in English: **Knowledge management**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Production Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041429**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15			15	
Number of hours of total student workload (CNPS)	30			30	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	1			1	
including number of ECTS points for practical (P) classes				1	
including number of ECTS points for direct teacher-student contact (BK) classes					

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

1. Has an established knowledge in the usage and communication in engineers' language.
2. Has a basic knowledge of manufacturing systems.
3. Has basic knowledge about management.

### SUBJECT OBJECTIVES

- C1. Familiarization of basic methods and techniques of knowledge management.
- C2. Familiarization of the practical implementation of the chosen strategies of knowledge management systems to industrial practice.
- C3. Familiarization of construction and possibilities of selected knowledge management tools.

## SUBJECT EDUCATIONAL EFFECTS

### I. Relating to knowledge:

PEK\_W01 - Has knowledge of the definition of the concept of knowledge and knowledge management, knows the goals of knowledge management. Can define knowledge management systems in the field of locating, acquiring, developing, transferring and using of knowledge, knowledge protection. Is able to identify the flows of knowledge between employees, organizational structure and environment of the organization.

PEK\_W02 - Is able to recognize the need to manage knowledge and identify solutions.

PEK\_W03 - Knows the technical capabilities of knowledge management systems and can offer different solutions in applications.

### II. Relating to skills:

PEK\_U01 - Is able to identify the elements and areas of knowledge management in the enterprise.

PEK\_U02 - Is able to analyze the technical or organizational problem and design appropriate configuration of knowledge management system.

PEK\_U03 - Can choose knowledge management tool, depending on the needs of a knowledge management system in the enterprise.

### III. Relating to social competences:

PEK\_K01 - Understands the need of lifelong learning in the field of activity of an engineer specializing in "Management and production engineering" and improve professional and social competence.

PEK\_K02 - Can think and critically analyze the functioning of systems to improve its effectiveness.

PEK\_K03 - Is aware of the responsibility for their own work and its impact on the functioning of the enterprise.

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	Organizational Issues. Definitions and dimensions of knowledge. Conceptual progression from data to knowledge. History of knowledge.	2
Lec2	Evolution of economy systems. Knowledge based economy. Learning organisation.	2
Lec3	Knowledge management foundations: infrastructure, mechanism and technologies.	2
Lec4	Processes and systems of knowledge management.	2
Lec5	Knowledge creating and capturing systems. Systems that distribution of knowledge.	2
Lec6	Knowledge management tools.	2
Lec7	Organizational impacts of knowledge management. Impact on people, processes, products and organizational performance. Shaping knowledge sharing culture.	2
Lec8	Test.	1
		Total hours: 15
Form of classes – Project		Number of hours
Proj1	Organizational issues: discussion on topics and rules for the project. Selecting an enterprise to study the knowledge management.	2

Proj2	Knowledge management audit in chosen enterprise: uncovering gaps and improving knowledge management performance in various areas of organization.	4
Proj3	Strategies for sourcing and deploying knowledge needed for organization.	4
Proj4	Selection and development of knowledge management tools in the enterprise.	3
Proj5	Presentation of completed projects	2
		Total hours: 15

#### TEACHING TOOLS USED

- N1. traditional lecture with the use of transparencies and slides  
N2. self study - preparation for project class  
N3. project presentation

#### 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	Test
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_U01, PEK_U02, PEK_U03	Report
F2	PEK_K01, PEK_K02, PEK_K03	Presentation of the project
P = F		

#### PRIMARY AND SECONDARY LITERATURE

### PRIMARY LITERATURE

- [1] Jashapara A., Knowledge Management: an Integrated Approach, Financial Times Prentice Hall, Harlow 2011  
[2] Becerra-Fernandez I., Sabherwal R., Knowledge Management. Systems and Processes, M.E. Sharpe, New York 2010

### SECONDARY LITERATURE

- [1] Iżykowski S., Sierżan D., Knowledge Management, Wrocław University Of Technology, 2011  
[2] Bergeon B., Essentials of Knowledge Management, John Wiley & Sons, New Jersey 2003  
[3] Byrne D., Essential Knowledge Management for Those Working with Infomation, Facet Publishing 2009  
[4] Uriarte A. F. Jr, Introduction to Knowledge Management, ASEAN, Japan 2008

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Knowledge management**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_W05, K2ZIP_W10	C1		N1
PEK_U01, PEK_U02, PEK_U03	K2ZIP_U05	C2, C3		N2, N3
PEK_K01, PEK_K02, PEK_K03	K2ZIP_K01	C2, C3		N2, N3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **Zarządzanie personelem**

Name in English: **Human resources management**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Production Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041430**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15				
Number of hours of total student workload (CNPS)	30				
Form of crediting	Crediting with grade				
Group of courses					
Number of ECTS points	1				
including number of ECTS points for practical (P) classes					
including number of ECTS points for direct teacher-student contact (BK) classes	0.6				

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

1. Fundamentals of management
2. Fundamentals of Marketing

### SUBJECT OBJECTIVES

- C1. Description of the roles and functions of managers.
- C2. Describe the process of recruitment to the organization.
- C3. To acquaint students with the issues associated with the development of human resources.



SUBJECT EDUCATIONAL EFFECTS

**I. Relating to knowledge:**

PEK\_W01 - Defining roles and functions performed by managers at various levels in the organization.

PEK\_W02 - Choose the method of motivating people to work.

PEK\_W03 - Explain the causes of conflicts and crises in the organization.

**II. Relating to skills:**

**III. Relating to social competences:**

PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	The roles and functions of managers	2
Lec2	Planning and recruitment of the organization	2
Lec3	Issues related to human resources development: improvement, evaluation, promotion and selection.	2
Lec4	Attracting employees to the organization. Methods and staff selection process. Selection and implementation to work.	2
Lec5	The methods to motivate people to work.	2
Lec6	Changes and innovations in the organization.	2
Lec7	Crisis and conflict within the organization - methods of stimulating and conflict resolution.	2
Lec8	Negotiations - its phases, tactics and strategies.	2
Lec9	Rewarding staff. Job evaluation. Pay systems.	2
Lec10	Base pay and other components. Benefices. Social insurance.	2
Lec11	Relationships trade unions and employer.	2
Lec12	The talks business, meetings and business meetings.	2
Lec13	Managing and leadership. The essence of leadership	2
Lec14	Styles of management. delegation of powers	2
Lec15	Verbal and non-verbal communication. The art of presentation.	2
		Total hours: 30

TEACHING TOOLS USED

N1. traditional lecture with the use of transparencies and slides

N2. case study

N3. self study - self studies and 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	Exam
P = F1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE

Gick A. Tarczyńska M .; Motivating employees. Systems - Technology - Practice. PWN

SECONDARY LITERATURE

Allan Pease .; Body language. How to read the thoughts of other people with their gestures. unity Kielce

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Human resources management**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
**Management and Manufacturing Engineering**

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	K2ZIP_W12	c1, c2, c3	lec1, lec2, lec3, lec4,lec5, lec6,lec8, lec9, lec10, lec13, lec14, lec15	n1, n2, n3

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

SUBJECT CARD

Name in Polish: **Dokumentowanie i audit systemów zarządzania jakością**

Name in English: **Documenting and Audit of Quality Management Systems**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Production Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041431**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15			30	
Number of hours of total student workload (CNPS)	30			90	
Form of crediting	Crediting with grade			Crediting with grade	
Group of courses					
Number of ECTS points	1			3	
including number of ECTS points for practical (P) classes				3	
including number of ECTS points for direct teacher-student contact (BK) classes	0.6			2.1	

## PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student has basic knowledge of management:

- (1) has knowledge of the basic management functions, features, goals and structures of organizations;
- (2) knows basic styles, methods and techniques of management;
- (3) understands development trends of management in the context of economic development;
- (4) understands and is able to recognize the impact of existing regulations on organizational and management solutions;
- (5) understands and can name the impact of introduced organizational and management solutions on the economic results of the enterprise;

2. Student has basic knowledge of quality management, mainly:

- (1) knows and understands the basis of modern approach to quality management;
- (2) knows the basic terms used in quality management;
- (3) know basic methods and tools for quality improvement;
- (4) knows and understands the importance of standards to build quality management systems in enterprises and to ensure quality in the supply chain;

She/he has basic knowledge of standardization and certification in the world, in the EU and in his/her EU member state:

- (1) knows general principles of standardization, as well as connections between standardization and development of economy, science and good organizational practices;
- (2) understands and is able to describe the importance of consensus in standardization;
- (3) can name the major standards organizations and identify standards issued by them;
- (4) distinguishes system /process certification from the product certification and/or personnel certification;
- (5) knows and distinguishes the concepts of accreditation, authorization, notification and certification.

3. Student can develop texts, flowcharts and presentations in electronic form using WORD, VISIO, POWERPOINT software.

She/he has the sense of responsibility for their own work, as well as the willingness to comply with the teamwork rules and to take responsibility for collaborative tasks. She /he knows the basic principles of the teamwork. She/he recognizes the importance of the teamwork in solving problems.

## SUBJECT OBJECTIVES

C1. Obtaining organized knowledge of the requirements and guidelines set out in the core standards of the ISO 9000 series, as the necessary basis for the practice of designing, documenting, implementing, reviewing, auditing, certification, maintaining and improving the quality management system consistent with ISO 9001 in an enterprise, regardless of its type and size and of the type of delivered "product". Understanding necessity to update knowledge in this area due to cyclic updates of standards and their widespread use.

C2. Acquiring basic skills and practical experience in designing, documenting, ensuring consistency, improving, maintaining and auditing the quality management system consistent with ISO 9001 on the example of a micro-enterprise.

C3. Strengthening the skills of cooperation and teamwork, as well as taking various organizational roles in the group, corresponding with various functions in the enterprise - executed in an elementary range associated with designing, documenting, providing consistency, maintaining, improving and auditing the quality management system consistent with ISO 9001, on the example of a micro-enterprise.

## SUBJECT EDUCATIONAL EFFECTS

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

PEK\_W01 - Student can characterize the family of ISO 9000 standards considering the scope of application of different standards and their use in the global supply chain. She/ he knows the basic assumptions (according to ISO 9000 and ISO 9001) and the basic requirements (according to ISO 9001) for the standardized quality management systems (QMS) - at least describes in detail the model of system based on a process approach, lists and recognizes the principles of quality management, as well as provides examples of their reflection in the basic requirements for QMS, identifies and describes, as well as explains the requirements for QMS distinguishing requirement groups (QMS processes and documentation, Management responsibility, Resource management, Product realization, Measurement, analysis and improvement).

PEK\_W02 - Student knows terminology of standardized quality management systems - at least within the scope specified by ISO 9000 standard she /he defines the terms, selects definitions for the terms , recognizes definitions of terms, recognizes the difference between similar terms and definitions, identifies and enumerates the terms specific for particular aspects of the quality management system, characterizes reasons for terminology changes in the context of standardization principles.

PEK\_W03 - Student knows the standard guidelines for auditing QMS (according to ISO 19011) - identifies and can describe and explain the principles of auditing, management of the audit program, conducting the audit process, requirements for auditors.

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

PEK\_U01 - Student is able to communicate using specialized quality management vocabulary and to interpret the content of ISO 9000, ISO 9001 and ISO 19011 for the application of the requirements and guidelines to an exemplary micro-enterprise.

PEK\_U02 - Student can identify and elementarily describe processes of the quality management system for an exemplary micro-enterprise, as well as create and improve selected elements of basic documentation for the system.

PEK\_U03 - In the elementary range student can plan, carry out and document the audit for selected elements of quality management system to comply with the ISO 9001.

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

PEK\_K01 - Student is able to think creatively and solve problems of documenting quality management system (QMS).

PEK\_K02 - Student is able to interact and work in a group, taking various roles corresponding with various functions in the QMS of an enterprise.

PEK\_K03 - Student is able to think in terms of systemic quality management . She/he understands the need to update knowledge in this area due to cyclic updates of standards and the prevalence of their use.

## PROGRAMME CONTENT

Form of classes – Lecture		Number of hours
Lec1	The ISO 9000 family of standards as the basis of standardized quality management systems (QMS) - narrow and wide understanding of the above family, thematic scope and purpose of each standard, history in the context of the functioning of standardization, compatibility of QMS with other management systems, widespread use and importance in the global supply chain, relationships with Polish and EU law, as well as with the CE marking. Basics of QMS according to ISO 9000 standard, including: 8 quality management principles, process approach, the PDCA cycle. Analysis of quality management system terminology according to ISO 9000 standard and its importance.	2

Lec2	Analysis of quality management system terminology according to ISO 9000 standard and its importance – continued. Introduction to application of ISO 9001 - in the context of a strategic decision of an organization, the factors affecting design and implementation of a QMS in accordance with ISO 9001, the model of a process-based QMS, relationships with ISO 9004 and the compatibility with other systems, purpose of specified requirements, the universal use by any organization and the limitations resulting out of it, references to ISO 9000.	2
Lec3	Analysis of the ISO 9001 requirements in the scope of general requirements regarding processes as a basis of QMS, with a comment on the practice of identifying / establishing and describing these processes . Analysis of standard requirements for documenting the QMS, with a comment as to the purpose and benefits of documenting and criteria for evaluation of the documentation.	2
Lec4	Review of ISO 9001 requirements in the scope of specific responsibilities of top management and resource management, with examples of organizational solutions.	2
Lec5	Product realization according to ISO 9001 - review of the requirements and their significance in the scope of : (1) planning product realization processes with reference to the general requirements, (2) processes associated with the client, and (3) design and development with particular emphasis on inspection, verification and validation, (4) purchasing, (5) production and service provision (controlled conditions, validation of processes, identification and traceability, customer property protection, preservation of the product and its components), (6) controlling the equipment for monitoring and measurement, with reference to the prevailing conditions .	2
Lec6	Review of the ISO 9001 requirements in the scope of measurement and monitoring, analyzing results and improvement. A detailed analysis of the requirements for internal audits, corrective and preventive actions as well as continuous improvement, with commentary and examples.	2
Lec7	Analysis of normative guidance of ISO 19011 on auditing QMS - principles of auditing, managing audit program, carry out the audit process, requirements for auditors. Implementation and certification of standardized QMS.	2
Lec8	Final test	1
		Total hours: 15
Form of classes – Project		Number of hours
Proj1	A. Organizational matters. B. Management responsibility in relation to the 8 quality management principles and the PDCA cycle. C. Determining a legal form, a product and an initial organizational structure of micro-enterprises as objects for further group work on the establishment and documentation of the quality management system, ending with a written QMS documentation project generated in controlled conditions.	2
Proj2	A. Overview of selected prepared parts of the documentation project (the effect of the previous hours of design). Determining in the groups the scope and extent of changes to be introduced in their own projects. B. The quality policy and quality objectives as documents of enterprise's QMS.	2

Proj3	A. Overview of selected prepared parts of the documentation project (the effect of the previous hours of design). Determining in the groups the scope and extent of changes to be introduced in their own projects. B. Meeting general requirements concerning quality management system - identification of necessary processes and structure of their connections. Outline of the processes map of the enterprise.	2
Proj4	A. Overview of selected prepared parts of the documentation project (the effect of the previous hours of design). Determining in the groups the scope and extent of changes to be introduced in their own projects.. B. Course of the process of product realization - from information on the potential demand for the product to delivery of the product and post-delivery service, including monitoring and measurements of compliance.	2
Proj5	A. Overview of selected prepared parts of the documentation project (the effect of the previous hours of design). Determining in the groups the scope and extent of changes to be introduced in their own projects. B. Detailing the course of the process of production and delivery, including monitoring and compliance measurements.	2
Proj6	A. Overview of selected prepared parts of the documentation project (the effect of the previous hours of design). Determining in the groups the scope and extent of changes to be introduced in their own projects. B. Documented procedures and records required directly by ISO 9001 as well as designing their graphical forms. Other records needed by the organization. Record control procedure.	2
Proj7	A. Overview of selected prepared parts of the documentation project (the effect of the previous hours of design). Determining in the groups the scope and extent of changes to be introduced in their own projects. B. Documents required directly by ISO 9001 and other documents needed by the organization. Document control procedure.	2
Proj8	A. Overview of selected prepared parts of the documentation project (the effect of the previous hours of design). Determining in the groups the scope and extent of changes to be introduced in their own projects. B. Types of actions to be taken in case of disclosure of any non-compliance. Procedure for control of nonconforming product /nonconformity.	2
Proj9	A. Overview of selected prepared parts of the documentation project (the effect of the previous hours of design). Determining in the groups the scope and extent of changes to be introduced in their own projects. B. Corrective action procedure. Preventive action procedure.	2
Proj10	A. Overview of selected prepared parts of the documentation project (the effect of the previous hours of design). Determining in the groups the scope and extent of changes to be introduced in their own projects. B. Internal audit procedure.	2
Proj11	A. Overview of selected prepared parts of the documentation project (the effect of the previous hours of design). Determining in the groups the scope and extent of changes to be introduced in their own projects. B. The groups' work on the merging parts of the developed documentation into coherent written projects of QMS documentation - quality manuals for defined micro-enterprises. Sorting and merging the realized introduction exercises into consistent documents to be assessed.	2

Proj12	A. Continuation of the groups' work on the merging parts of the developed documentation into coherent written projects of QMS documentation - quality manuals for defined micro-enterprises. B. Exercises in analyzing and documenting nonconformities as not meeting the requirements of ISO 9001 and presentation of results of completed exercises in the form of a coherent document to be assessed. Preparation of documents directing external teams to conduct an internal audit in particular micro-enterprises within a specified scope regarding documenting QMS in accordance with the requirements of ISO 9001.	2
Proj13	A. Ordering an audit together with submitting micro-enterprise's quality manual. Other activities related to initiating the audit. B. Preliminary review of the micro-enterprise's QMS documentation. Preparation for the implementation of an audit examination of QMS documentation in the micro-enterprise, including creation of a checklist.	2
Proj14	A. The audit examination of QMS documentation in the micro-enterprise - collecting and verifying information, documenting audit evidences by work records, developing audit findings and preparation of audit conclusions. B. Preparation of an audit report, including attachment of work records.	2
Proj15	A. Distribution of the audit report. Completion of the audit and taking the audit follow-up actions. B. Organization of the final stage of the project examination and testing knowledge of the professional terminology.	2
		Total hours: 30

TEACHING TOOLS USED		
<p>N1. Traditional lecture using slides; informational mini-lecture and / or instruction as well as discussion during the course of project</p> <p>N2. Introductory exercises - analysis and interpretation of the text of the ISO 9001 standard and / or other source documents</p> <p>N3. Own work – (1) self-study of the topic and preparation for the final test of the lecture, (2) preparation for classes of design and supervision of the QMS documentation and for presentation of developed parts of the QMS documentation project, (3) preparation of coherent QMS documentation, (4) preparation for classes of auditing QMS, (5) preparation of the audit report</p> <p>N4. presentation of parts of the QMS documentation project</p> <p>N5. work in groups connected with the discussion and / or role playing</p>		

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, PEK_U03	Final test and scoring active participation in the lecture (which - if a student reaches at least the minimum required for passing the test - could potentially increase the final grade to half a degree up)
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_U01, PEK_U02, PEK_U03, PEK_K01, PEK_K02, PEK_K03	Evaluation of developed QMS documentation
F2	PEK_U01, PEK_U03	Evaluation of the result of exercises in analysis and description of non-compliance
F3	PEK_U01, PEK_U02, PEK_U03, PEK_K01, PEK_K02, PEK_K03	Evaluation of the prepared audit report
F4	PEK_U01, PEK_U02, PEK_U03, PEK_K01, PEK_K02, PEK_K03	Evaluation of active participation in class (presentation, discussion of the presentation, activity in group work, attendance)
P = średnia arytmetyczna z F1, F2, F3, F4, F5 i F6		

PRIMARY AND SECONDARY LITERATURE

### PRIMARY LITERATURE

1. Sujak-Cyrul, B. (2011). Quality management systems: an introduction to the Project of documenting and audit of quality management systems. Wrocław : Wrocław University of Technology; Łódź: PRINTPAP.
2. Hoyle, D. (2009). ISO 9000 quality systems handbook - using the standards as a framework for business improvement . Amsterdam - Boston : Butterworth-Heinemann.
3. ISO 9001:2008, Quality management systems - Requirements. / implemented as the Polish standard: PN-EN ISO 9001:2009, Systemy zarządzania jakością - Wymagania. (bilingual English-Polish version )
4. Draft International Standard ISO/DIS 9001:2014 (E), Quality management systems - Requirements.
5. The training materials developed by the lecturer/ lecturers

### SECONDARY LITERATURE

1. ISO 9000:2005, Quality management systems - Fundamentals and vocabulary. / implemented as the Polish standard : PN-EN ISO 9000:2006, Systemy zarządzania jakością - Podstawy i terminologia. (bilingual English-Polish version)
2. ISO 9004:2009, Managing for the sustained succes of an organization - A quality management approach. / implemented as the Polish standard : PN-EN ISO 9004:2010, Zarządzanie ukierunkowane na trwały sukces organizacji - Podejście wykorzystujące zarządzanie jakością. (bilingual English-Polish version)
3. ISO 19011: 2011, Guidelines for auditing management systems. / implemented as the Polish standard: PN-EN ISO 9004:2012. Wytyczne dotyczące auditowania systemów zarządzania. ( initially only in English version, and later in a separate Polish version)

**MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
Documenting and Audit of Quality Management Systems  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY  
Management and Manufacturing Engineering**

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	K2ZIP_W10	C1	Lec1 - Lec6, Lec8	N1
PEK_W02	K2ZIP_W10	C1	Lec1 - Lec8	N1
PEK_W03	K2ZIP_W10	C1	Lec7 - Lec8	N1
PEK_U01	K2ZIP_PM_U06	C1, C2	Proj1 - Proj15	N2, N3, N4, N5
PEK_U02	K2ZIP_PM_U10	C1, C2	Proj1 - Proj12	N2, N3, N4, N5
PEK_U03	K2ZIP_PM_U10	C1, C2	Proj10, Proj12 - Proj15	N2, N3, N4, N5
PEK_K01	K2ZIP_K05	C2, C3	Proj1 - Proj15	N2, N3, N4, N5
PEK_K02	K2ZIP_K04, K2ZIP_PM_K01	C2, C3	Proj1 - Proj15	N5
PEK_K03	K2ZIP_K01	C1, C2, C3	Proj1 - Proj15	N2, N3, N4, N5

SUBJECT SUPERVISOR

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Faculty of Mechanical Engineering

## SUBJECT CARD

Name in Polish: **PRACA DYPLOMOWA I, II**

Name in English: **MASTER THESIS**

Main field of study (if applicable): **Management and Manufacturing Engineering**

Specialization (if applicable): **Production Management**

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

Kind of subject: **obligatory**

Subject code: **ZPM041451**

Group of courses: **no**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)				90	
Number of hours of total student workload (CNPS)				600	
Form of crediting				Crediting with grade	
Group of courses					
Number of ECTS points				20	
including number of ECTS points for practical (P) classes				20	
including number of ECTS points for direct teacher-student contact (BK) classes				20.0	

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

1. Has knowledge in the management and production engineering field documented positive marks in all subjects including Production Management specialization courses
2. Can obtain information from the literature. Analyze and apply on the basis of observations and analyzes.

### SUBJECT OBJECTIVES

- C1. Individual preparation of Master thesis, including the examination of the problem in order to work, the selection of relevant methods and techniques, and propose a method for its solution and defend the results of the work
- C2. Strengthen the skills to obtain information from various sources and to prepare and present an oral and multimedia presentation on the issues resolved in the framework of the thesis
- C3. Acquisition of and preserve individual work ability, identify goals and objectives for implementation, selection of appropriate methods and techniques, and document their work

## SUBJECT EDUCATIONAL EFFECTS

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

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

PEK\_U01 - Can diagnose analyze problems related to the management of manufacturing companies, selected the appropriate methods and techniques, and plan their implementation

PEK\_U02 - Can obtain information from literature, databases and other carefully selected sources, also in foreign languages is also able to integrate the information, make their interpretation and critical evaluation

PEK\_U03 - Can analyze and evaluate existing manufacturing processes and manufacturing systems and propose ways of reorganization and optimization due to certain criteria optimization

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

PEK\_K01 - Have sense of responsibility for their own work and in implementing their tasks

PEK\_K02 - Can define priorities appropriately to fulfill the given task

PEK\_K03 - Understands the need for learning throughout life, and knows the possibility of continuous training and professional skills development, personal and social

## PROGRAMME CONTENT

## TEACHING TOOLS USED

N1. case study

N2. tutorials

N3. self study - self studies and preparation for examination

## PRIMARY AND SECONDARY LITERATURE

### PRIMARY LITERATURE

### SECONDARY LITERATURE

1. Majchrzak J.:Metodyka pisania prac magisterskich i dyplomowych, Wydawnictwo Uniwersytetu Ekonomicznego, Poznań 2009  
2. Brycz B.: Przewodnik dla piszących prace magisterskie w zakresie zarządzania, Polskie Wydawnictwo Ekonomiczne, Warszawa 2011

## MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT **MASTER THESIS** AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Management and Manufacturing Engineering**

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, PEK_U02, PEK_U03	K2ZIP_U12, K2ZIP_U14			
PEK_K01, PEK_K02, PEK_K03	K2ZIP_K04			

SUBJECT SUPERVISOR

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