Zał. nr 4 do ZW 64/2012

FACULTY of **Computer Science and Management**/ DEPARTMENT……

SUBJECT CARD

Name in Polish: Przetwarzanie równoległe i rozproszone
Name in English: Parallel and Distributed Computing
Main field of study (if applicable): Informatics
Specialization (if applicable): Computer Engineering
Level and form of studies: ~~1st~~/ 2nd* level, full-time / ~~part-time~~*
Kind of subject: obligatory ~~/ optional / university-wide*~~
Subject code INZ000136Wcl
Group of courses YES ~~/ 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	60	60		
Form of crediting	Examination / ~~crediting with grade*~~	Examination / crediting with grade*	Examination / crediting with grade*	Examination / crediting with grade*	Examination / crediting with grade*
For group of courses mark (X) final course	X				
Number of ECTS points	2	2	2		
including number of ECTS points for practical (P) classes	0	0	2		
including number of ECTS points for direct teacher-student contact (BK) classes	1.2	1.2	1.2		

*delete as applicable

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic knowledge of computer architecture and organization
2. Programming skills at an intermediate level

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SUBJECT OBJECTIVES

C1 Acquainting students with different environments that allow parallel processing

C2 Acquainting students with the most popular parallel algorithms

C3 Acquainting students with different techniques used during program parallelization

C4 Acquainting students with different parallel computers architecture

C5 Acquisition of the ability to choose the most suitable parallel architecture to the solved problem

C6 Acquisition of the ability of parallel programming using different environments

C7 Acquisition of the ability to solve different problems related to parallel and distributed

computing

C8 Acquisition of the ability to apply the principles of health and safety work processing

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 He knows different environments that allow parallel processing.

PEK_W02 He knows most popular parallel algorithms

PEK_W03 He knows different approaches to program parallelization

PEK_W04 He knows different parallel computers architectures

relating to skills:

PEK_U01 He is able to choose parallel environment to the selected problem

PEK_U02 He is able to write programs under different parallel distributed environment

PEK_U03 He is able to solve different problems related to parallel and distributed computing

PEK_U04 Is able to use the principles of safety and health at work

PROGRAMME CONTENT

Form of classes - lecture		**Number of hours**
Lec 1	Parallel and distributed computing - basic definitions. Taxonomy of parallel computers. Static and dynamic interconnection networks, typical topologies	2
Lec 2	MPI standard. Message passing communication. Collective communication.	2
Lec 3	Evaluations of parallel systems: performance metrics, scalability of parallel systems, Amdhal, Gustafson and other laws. Using granularity for parallel program evaluation.	2
Lec 4	Parallelization and vectorization techniques. Dependencies in sequential programs and the ways of its elimination.	2
Lec 5	Parallel matrix multiplication and parallel sorting algorithms	2
Lec 6	Parallel graph algorithms	2
Lec 7	Automatic program parallelization, dependence tests.	2
Lec 8	Loop transformation techniques	2
Lec 9	Architecture of GPU. Programming in CUDA environment	2
Lec 10	Load balancing, task mapping and task scheduling in parallel distributed environments	2
Lecc11	Parallel programming for multicore processors	2
Lec 12	Parallel and distributed processing environments: shared memory parallel processing, message passing and client-server models.	2
Lec 13	Explicit\implicit parallel programming languages, shared\distributed	2

	memory programming paradigms, data and algorithm parallelism.	
Lec 14	Parallel program design methodology	2
Lec 15	New trends in parallel and distributed computing	2
	Total hours	30

Form of classes - class		Number of hours
Cl 1	Presentation of classes scope and grading principles. Solving simple problems related with parallel execution I.	1
Cl 2	Solving simple problems related with parallel execution II.	2
Cl 3	Scalability analysis. Using Amdhal law for performance prediction.	2
Cl 4	Determining dependences in sequential programs and its elimination.	2
Cl 5	Evaluation of different parallel algorithms.	2
Cl 6	Evaluation of different transformation techniques.	2
Cl 7	Evaluation of different loop transformation techniques	2
Cl 8	Evaluation of different task mapping and task scheduling algorithms.	2
	Total hours	15

Form of classes - laboratory		Number of hours
Lab1	Presentation of lab scope, presentation of grading principles, training from health and safety at work. Familiarization with used laboratory tool.	1
Lab2	Implementation of simple algorithm that uses point to point communication using MPI	2
Lab3	Implementation of simple algorithm that uses collective communication using MPI	2
Lab4	Implementation of selected parallel algorithm using MPI	2
Lab5	Performance analysis of implemented parallel algorithm using the traditional method and by analyzing of its granularity	2
Lab6	Implementation of selected loop transformation technique using MPI. Performance evaluation of implemented algorithm.	2
Lab7	Implementation selected for laboratory 3 parallel algorithm using GPU	2
Lab8	Performance analysis of implemented parallel algorithm using the traditional method	2
	Total hours	15

Form of classes - project		Number of hours
Proj1		
	Total hours	

Form of classes - seminar		Number of hours
Sem1		
	Total hours	

TEACHING TOOLS USED
N1. Lecture supported by multimedia presentations (slideshow) N2. Cluster of computers running under MPI N3. GPU server N4. Classes supported by blackboard

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation(F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1 – (lecture)	PEK_W01 PEK_W02 PEK_W03 PEK_W04	Quizzes during the lecture, student activity during the lecture, students answering on questions during lecture
F2 – (laboratory)	PEK_U01 PEK_U02 PEK_U04	Checking of student preparation for exercise realization, assessment (points allocated) the reports of the exercises. Evaluation of the quality of submitted by students programs.
F3 – (class)	PEK_U01 PEK_U03	Quizzes during the classes, student activity during the classes, assessment of students solutions presented during classes (points allocated).

P - the final assessment will be issued on the basis of partial grades (points) received from the final exam (E) and the evaluation of F1, F2, F3 as follows:

Grade = 40% * E + 10% * F1 + 25% * F2 + 25% * F3 In order to receive a positive grade from each activity is required to obtain at least 40% of the points.

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] V. Kumar i inni, "Introduction to Parallel Computing", The Benjamin/Cummings Pub., New York 2003.

[2] J.M. Crichlow, „An introduction to distributed and parallel computing", Prentice Hall, London 1997

[3] Foster I., "Designing and Building Parallel Programs", http://www.mcs.aul.gov/dbpp/text/book.html

[4] B. Wilkinson, M. Allen, "Parallel Programming, Prentice Hall, 2005

[5] Writing Message-Passing Parallel Programs with MPI, Course Notes, http://www.zib.de/zibdoc/mpikurs/mpi-course.pdf

[6] Peter Pacheco, Parallel Programming with MPI, Morgan Kaufmann Pub. http://www.cs.usfca.edu/~peter/ppmpi/

[7] CUDA documentation

[8] Different microprocessors documentation

SECONDARY LITERATURE:

[1] D. Patterson, J. Hennessy, "Computer Architecture – a Quantitave Approach", Elsevier

[2] A.Y.H. Zomaya, „Parallel and distributed computing handbook", McGraw-Hill, New York 1996

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Parallel and Distributed Computing
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Informatics**
AND SPECIALIZATION **Computer 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 (knowledge)	K2INF_W06	C1	Lec1, Lec2, Lec9, Lec10, Lec11, Lec12, Lec13,Lec15	N1
PEK_W02	K2INF_W06	C2	Lec3, Lec5, Lec6	N1
PEK_W03	K2INF_W06	C3	Lec4, Lec7, Lec8, Lec10	N1
PEK_W04	K2INF_W06	C4	Lec1, Lec9, Lec11, Lec13, Lec14, Lec15	N1
PEK_U01 (skills)	K2INF_U08	C5	Lab5, Lab6, Lab8	N2, N3
PEK_U02	K2INF_U08	C6	Lab2, Lab3, Lab4, Lab7	N2, N3
PEK_U03	K2INF_U08	C7	Cl1 – Cl8	N4
PEK_U04	K2INF_U09	C8	Lab1 – Lab8	N2, N3

** - enter symbols for main-field-of-study/specialization educational effects
*** - from table above