Zał. nr 4 do ZW 64/2012

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

SUBJECT CARD

Name in Polish: Wprowadzenie do systemów równoległych i rozproszonych
Name in English: Introduction to Parallel and Distributed Systems
Main field of study (if applicable): Informatics
Specialization (if applicable):
Level and form of studies: 1st/ ~~2nd*~~ level, full-time / ~~part-time~~*
Kind of subject: obligatory ~~/ optional / university-wide*~~
Subject code INZ000277Wcl
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	45	45		
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	1	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	0.6	1.2		

*delete as applicable

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic knowledge about computer architecture and organization
2. Programming skills at a basic level

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SUBJECT OBJECTIVES

C1 Acquainting students with basic knowledge about parallel and distributed computer environments

C2 Acquainting students with basic knowledge about parallel algorithms

C3 Acquainting students with basic knowledge related to parallel and distributed processing

C4 Acquisition of the ability of parallel programming using selected distributed and parallel environment

C5 Acquisition of the ability to solve simple problems related to parallel and distributed processing

C6	Acquisition of the ability to apply the principles of health and safety work

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 Knows different approaches to parallel and distributed processing.

PEK_W02 Knows the basic parallel algorithms

PEK_W03 Knows the parallel processing environments

PEK_W04 Knows different problems related to parallel and distributed processing and the ways of its solving

relating to skills:

PEK_U01 He is able to solve simple problems related to parallel and distributed processing

PEK_U02 He is able to write simple parallel programs under MPI environment

PEK_U03 He 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 processing - basic definitions. Parallel programming languages, shared-memory and distributed memory programming paradigms. MPI standard.	2
Lec 2	Programming using MPI environment. Message passing communication, basic concepts, examples of simple parallel algorithms	2
Lec 3	Taxonomy of parallel computers, typical architecture of parallel computers. Static and dynamic interconnection networks, typical topologies, different routing strategy.	2
Lec 4	Collective communication ("one-to-all", "all-to-all" and others) for different communication network topologies and routing strategies - theirs implementation in MPI	2
Lec 5	Parallel matrix multiplication algorithms	2
Lec 6	Parallel sorting algorithms	2
Lec 7	Evaluations of parallel systems: performance metrics, scalability of parallel systems, Amdhal, Gustafson and other laws.	2
Lec 8	Parallel and distributed processing environments: shared memory parallel processing, message passing and client-server models.	2
Lec 9	Explicit\implicit parallel programming languages, shared\distributed memory programming paradigms, data and algorithm parallelism.	2
Lec 10	Parallization techniques. Dependencies in sequential programs and the way of its elimination.	2
Lec 11	Task mapping and task scheduling algorithms for parallel environments	2
Lec 12	Architecture and programming of GPU	2

Lec 13	Programming in CUDA environment	2
Lec 14	Parallel program design methodology – case study	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 problem related with parallel execution I.	1
Cl 2	Solving simple problem related with parallel execution II.	2
Cl 3	Comparing collective communication primitives for different network topologies if using store-and-forward routing strategy	2
Cl 4	Comparing collective communication primitives for different network topologies if using cut-through routing strategy	2
Cl 5	Scalability analysis. Using Amdhal law for performance prediction.	2
Cl 6	Determining dependences in sequential programs and its elimination.	2
Cl 7	Evaluation of different transformation techniques.	2
Cl 8	Comparing 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	Point to point communication in MPI	2
Lab3	Implementation of simple algorithm that uses point to point communication	2
Lab4	Collective communication in MPI	2
Lab5	Implementation of simple algorithm that uses collective communication	2
Lab6	Implementation of simple algorithm that uses global reduction operations	2
Lab7	Implementation of parallel matrix multiplication algorithm	2
Lab8	Implementation of parallel sorting algorithm	2
	Total hours	15
Form of classes - project		**Number of hours**
Proj1		
Proj2		
	Total hours	
Form of classes - seminar		**Number of hours**
Sem1		
Sem2		
	Total hours	

TEACHING TOOLS USED

N1. Lecture supported by multimedia presentations (slideshow)
N2. Cluster of computers running under MPI

N3. 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_U02 PEK_U03	Checking of student preparation for exercise realization, assessment of the reports of the exercises (points allocated). Evaluation of the quality of submitted by students programs, implementation during the laboratory additional tasks formulated during the laboratory (on-line programing)
F3 – (class)	PEK_U01	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/

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

Introduction to Parallel and Distributed Systems

AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Informatics** AND SPECIALIZATION

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)	K1INF_W12	C3	Lec1, Lec3, Lec7, Lec8, Lec9, Lec14, Lec15	N1
PEK_W02	K1INF_W12	C2	Lec2, Lec5, Lec6	N1
PEK_W03	K1INF_W12	C1	Lec1, Lec2, Lec4, Lec12, Lec13	N1
PEK_W04	K1INF_W12	C3	Lec10, Lec11	N1
PEK_U01 (skills)	K1INF_U04	C5	Cl1 – Cl8	N3
PEK_U02	K1INF_U04	C4	Lab1 – Lab8	N2
PEK_U03	K1INF_U14	C6	Lab1 – Lab8	N2

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

*** - from table above