

FACULTY <b>Computer Science and Management</b> / DEPARTMENT.....					
<b>SUBJECT CARD</b>					
<b>Name in Polish</b> Modelowanie i analiza systemów webowych					
<b>Name in English</b> <i>Modeling and Analysis of Web Systems</i>					
<b>Main field of study (if applicable):</b> Informatics					
<b>Specialization (if applicable):</b> Computer Engineering					
<b>Level and form of studies:</b> 1st/ <del>2nd</del> * level, full-time / <del>part-time</del> *					
<b>Kind of subject:</b> obligatory / <del>optional</del> / <del>university-wide</del> *					
<b>Subject code</b> INZ0135					
<b>Group of courses</b> YES / <del>NO</del> *					
	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30		30		
Number of hours of total student workload (CNPS)	90		90		
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					
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		1,8		

\*delete as applicable

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

- 1 Knowledge of advanced methods and techniques of data analysis
- 2 Knowledge of the basics of the Internet and Web-based systems
- 3 Knowledge of the basics of simulation systems

**SUBJECT OBJECTIVES**

- C1 familiarize students with current knowledge in the field of Web-based systems modeling
- C2 familiarize students with current knowledge in the field of forecasting efficiency of web data mining methods
- C3 Presentation of the problems associated with the use of methods of spatial predictions about the performance of web systems
- C4 Gain skills of students in characterization of issues from different fields and their spatial modeling and performance prediction.
- C5 Preparing to work in computer labs and learning the rules of safety associated with this work.

### SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK\_W01 has detailed knowledge of the underpinnings of theory and knows the methods and tools and can solve complex tasks of modeling and analysis of web-based systems

relating to skills:

PEK\_U01 It can be used to formulate and solve tasks and research problems of varying difficulty, on Web-based systems, simulation and experimental methods, as well as to evaluate their suitability.

PEK\_U02 Can formulate and test hypotheses related to the problems of engineering and simple research problems, knows how to select and use appropriate techniques and technologies for the implementation of IT solutions in the field of studying a field, he can make a critical analysis of the course of action being developed solutions and propose improvements to the techniques

PEK\_U03 Can use computer labs and knows the rules of safety in these labs.

relating to social competences:

PEK\_K01 recognizes the need to use these methods for modeling and data analysis in order to assess the performance of Web-based systems

PEK\_K02 Identifies the use of spatial forecasting methods in other fields and technology

### PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Lec 1	Introduction to the course. Description of the course, the organization of classes and examination. Basics of Internet.	2
Lec 2	Internet infrastructure	2
Lec 3	TCP/IP protocol stack, IPv4, Distance metrics.	2
Lec 4	TCP transport.	2
Lec 5	DNS, King.	2
Lec 6	HTTP - current and future developments, Web traffic characteristics.	2
Lec 7	Web performance issues	2
Lec 8	Web performance prediction.	2
Lec 9	Spatial econometrics in theory	2
Lec 10	Spatial econometrics in practice	2
Lec 11	Parallel applications in Web environment	2
Lec 12	End-to-end performance of Web services	2

Lec 13	Method of performance measurement and profiling parallel applications in Web environment	2
Lec 14	Management of distributed systems	2
Lec 15	Discussion of student assignments, preparation for the exam	2
	Total hours	30
<b>Form of classes - class</b>		<b>Number of hours</b>
Lab 1	Organization classes. Health and Safety Training.	2
Lab 2	Reminder of C++ language and introduction to the CSIM package	2
Lab 3	Random numbers and streams	2
Lab 4	CSIM objects: processes, facility, event, tables	2
Lab 5	Queuing networks, M/M/1 and M/M/N queue	2
Lab 6	Queuing networks, M/M/1 and M/M/N queue Contd.	2
Lab 7	Simulation M/M/1 queue with using Markov Chain	2
Lab 8	Servers with JSQ Policy	2
Lab 9	Generating synthetic trace file	2
Lab 10	Fork-Join Queueing System	2
Lab 11	Fork-Join Queueing System Contd.	2
Lab 12	Social Network	2
Lab 13	Social Network Contd.	2
Lab 14	Social Network 2	2
Lab 15	Final grading	2
	Total hours	30
<b>Form of classes - laboratory</b>		<b>Number of hours</b>
Lab 1		
Lab 2		
	Total hours	
<b>Form of classes - project</b>		<b>Number of hours</b>

Proj 1		
Proj 2		
	Total hours	

Form of classes - seminar		Number of hours
	Total hours	

TEACHING TOOLS USED
N1. Lectures supported by multimedia presentations
N2. Multimedia presentations
N3 Scientific and technical publications
N4. E-learning system used for publication of teaching materials or announcements, collection and assessment of student work
N5. Additional consultations for students.

#### 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
<b>P1 (Lab)</b>	PEK_U01, PEK_U02 PEK_U03	Evaluation of the work at the laboratory (observation of student activities. Brief individual interview on current laboratory practice (demonstration program, the results of its operations and applications), report.
<b>P2 (Lec)</b>	PEK_W01, PEK_U01-2, PEK_K01-2	Examination of the course or development problem made by the student on an assigned topic or research on the subject of the object.

PRIMARY AND SECONDARY LITERATURE
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**PRIMARY LITERATURE:**

- [1] Menasce D.A., Almeida V.A.F., *Capacity planning for Web performance. Metrics, models, and methods*, Prentice Hall PTR, New Jersey, 2002.
- [2] Colajanni M., Yu P.S., Cardellini V., *Scalable Web-Server systems: architectures, models and load balancing algorithms*, SIGMETRICS, 2000
- [3] Readings proposed by lectures and instructors

**SECONDARY LITERATURE:**

- [1] Rak T., *Modelowanie i analiza interaktywnych systemów internetowych realizujących obsługę szybkozmiennych ofert*, rozprawa doktorska, AGH, Kraków 2007
- [2] Zatwarnicki K., Zatwarnicka A., *Budowa symulatora serwisu webowego z wykorzystaniem pakietu CSIM*, Zeszyty 2004
- [3] H-C. Lin, C.S. Raghavendra, *An Analysis of the Join the Shortest Queue (JSQ) Policy*, IEEE, 1992
- [4] V. Gupta, M. Harchol-Balter, K. Sigman, W. Whitt, *Insensitivity for PS server farms with JSQ routing*, IFIP, Cologne, Germany, 2007
- [5] Kim, C., Agrawala, A. K. (Feb. 1989). *Analysis of the Fork-Join Queue*. IEEE Transactions on Computers 38 (2): 250–255
- [6] Lebrecht, Abigail; Knottenbelt, William J. (June 2007). Response Time Approximations in Fork-Join Queue. 23rd Annual UK Performance Engineering Workshop (UKPEW).
- [7] Serfozo, Richard (2009). Basics of Applied Stochastic Processes. Springer. p. 78–80
- [8] Yan Hu, Dah-Ming Chiu, John C. S. Lui, *Entropy Based Adaptive Flow Aggregation*. IEEE/ACM Transactions on Networking, 2007.
- [9] Yan Hu, Dah-Ming Chiu, John C. S. Lui, *Adaptive Flow Aggregation - A New Solution for Robust Flow Monitoring under Security Attacks*. <http://www.docstoc.com/docs/80768213/>
- [10] Tutorial: *Getting Started: CSIM19 Simulation Engine (C++ Version)*, Mesquite Software, Inc.
- [11] Mesquite Software, Inc.: <http://www.mesquite.com/>
- [12] Geostatistical tools

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

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**MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT**  
**Modeling and Analysis of Web Systems**  
**AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY Infomatics**  
**AND SPECIALIZATION Computer Engineering**

<b>Subject educational effect</b>	<b>Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)**</b>	<b>Subject objectives***</b>	<b>Programme content***</b>	<b>Teaching tool number***</b>
<b>PEK_W01</b>	K2INF_W06_S2ITM_W01	C1, C4	Lec1-15, Lab1-15	N1, N2, N3, N4, N5
<b>PEK_U01</b>	K2INF_U08_S2ITM_U02	C3, C4	Lec1-15, Lab1-15	N1, N2, N3, N4, N5
<b>PEK_U02</b>	K2INF_U08_S2ITM_U06	C3, C4	Lec1-15, Lab1-15	N1, N2, N3, N4, N5
<b>PEK_U03</b>	K2INF_U09	C5	Lab1	N2
<b>PEK_K01</b>	K2INF_U08_S2ITM_K01	C1, C2, C3,C4	Lec1-15, Lab1-15	N1, N2, N3, N4, N5
<b>PEK_K02</b>	K2INF_U08_S2ITM_K02	C1, C2, C3, C4	Lec1-15, Lab1-15	N1, N2, N3, N4, N5

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

\*\*\* - from table above