Course Description

1. Course title: PERFORMANCE EVALUATION OF COMPUTER SYSTEMS
2. Course code: PECS

4. Level of studies: MSc
5. Mode of studies: intramural studies
6. Field of study: computer science (informatics) - RAU
7. Profile of studies: general academic
8. Programme: --
9. Semester: I
10. Faculty teaching the course: Institute of Informatics
11. Course instructor: Prof. dr hab. inż. Tadeusz Czachórski
12. Course classification: common
13. Language of instruction: English
14. Course status: compulsory
15. Pre-requisite qualifications: knowledge of probability theory and stochastic processes on the level taught at BA courses; rudiments of computer networks and computer systems architectures and principles of their performance
16. Course objectives: to achieve skills in the use of mathematical methods used in modelling and performance evaluation of computer systems.
17. Description of learning outcomes:

<table>
<thead>
<tr>
<th>Nr</th>
<th>Learning outcomes description</th>
<th>Method of assessment</th>
<th>Teaching methods</th>
<th>Learning outcomes reference code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Student gets knowledge on operational models and other analytical queueing models (Markov chain models, diffusion approximation) of computer systems.</td>
<td>test</td>
<td>Lecture</td>
<td>K_W04</td>
</tr>
<tr>
<td>2</td>
<td>Student gets knowledge on mean value analysis applied to model computer systems.</td>
<td>test</td>
<td>Lecture</td>
<td>K_W01</td>
</tr>
<tr>
<td>3</td>
<td>Student gets knowledge on Markov chain models in the performance analysis of computer systems.</td>
<td>test</td>
<td>Laboratory</td>
<td>K_U10</td>
</tr>
<tr>
<td>4</td>
<td>Student gets knowledge on the use of simulation to evaluate performances of computer systems. Student is able to evaluate simulation errors.</td>
<td>test</td>
<td>Laboratory</td>
<td>K_U09</td>
</tr>
<tr>
<td>5</td>
<td>Student is able to apply the acquired knowledge to study the performances of a proposed topology of a computer system.</td>
<td>test</td>
<td>Laboratory</td>
<td>K_U08</td>
</tr>
</tbody>
</table>

18. Teaching modes and hours

Lecture / BA / MA Seminar / Class / Project / Laboratory
Sem 1 (8): lecture - 15 h, laboratory - 15 h

19. Syllabus description:

Lecture:
Operational models of computer systems: basic laws for the resource utilization, throughput and response time. Definition of a system bottleneck. Asymptotic and based on balanced systems bounds on a system throughput and response time.
The use of bounds in analysis of the impact of various modifications (exchange of disks, balancing disks, faster processor, virtual memory) on the performance of a computer system. Queueing networks as a model of a system - the use of mean value analysis (MVA), models of the open and closed network, introduction of multiple classes of customers, the use of approximate MVA algorithm. Simple probabilistic models and their justification. Single server models based on Markov chains, introduction of limited queue and loss probability, parallel service channels, limited set of customers; examples of Markov models of a central server system and data base system. An analysis of the complexity of models versus their results. Numerical methods of solution of complex Markov models.
Laboratory: Simple simulation queueing models and models of computer systems written with the use of OMNET++ system.

20. Examination: no examination

21. Primary sources:

22. Secondary sources:

23. Total workload required to achieve learning outcomes

<table>
<thead>
<tr>
<th>Lp.</th>
<th>Teaching mode</th>
<th>Contact hours / Student workload hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lecture</td>
<td>15/15</td>
</tr>
<tr>
<td>2</td>
<td>Classes</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Laboratory</td>
<td>15/15</td>
</tr>
<tr>
<td>4</td>
<td>Project</td>
<td>/</td>
</tr>
<tr>
<td>5</td>
<td>BA/MA Seminar</td>
<td>/</td>
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<tr>
<td>6</td>
<td>Other</td>
<td>/</td>
</tr>
<tr>
<td></td>
<td>Total number of hours</td>
<td>30/30</td>
</tr>
</tbody>
</table>

24. Total hours: 60

25. Number of ECTS credits: 2
26. Number of ECTS credits allocated for contact hours: 1
27. Number of ECTS credits allocated for in-practice hours (laboratory classes, projects):1

28. Comments:

Approved:

……………………………. …………………………………………………
(date, Instructor’s signature)   …………………………………………………
(date, the Director of the Faculty Unit signature)