1. Course title: PERFORMANCE EVALUATION OF COMPUTER NETWORKS

2. Course code


4. Level of studies: MSc

5. Mode of studies: intramural studies

6. Field of study: computer science (informatics) (FACULTY SYMBOL) RAU

7. Profile of studies: general academic

8. Programme:

9. Semester: I (S2)

10. Faculty teaching the course: Institute of Informatics

11. Course instructor: Prof. dr hab. inż. Tadeusz Czachórski

12. Course classification: common

13. Course status: compulsory

14. Language of instruction: English

15. Pre-requisite qualifications: knowledge of probability theory and stochastic processes on the level taught at BA courses; rudiments of computer networks architectures and principles of their performance, especially of the performance of communication protocols (TCP/IP)


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>W1</td>
<td>Student gets knowledge on operational models of computer networks</td>
<td>test</td>
<td>Lecture</td>
<td>K2A_W04</td>
</tr>
<tr>
<td>W2</td>
<td>Student gets knowledge on mean value analysis applied to model computer networks</td>
<td>test</td>
<td>Lecture</td>
<td>K2A_W06</td>
</tr>
<tr>
<td>W3</td>
<td>Student gets knowledge on Markov chain models in the performance analysis of computer networks</td>
<td>test</td>
<td>Lecture</td>
<td>K2A_W06</td>
</tr>
<tr>
<td>U1</td>
<td>Student gets knowledge on the use of simulation to evaluate performances of computer networks. Student is able to evaluate simulation errors.</td>
<td>test</td>
<td>Laboratory</td>
<td>K2A_U06-8</td>
</tr>
<tr>
<td>U2</td>
<td>Student is able to apply the acquired knowledge to study the performances of a proposed topology of a computer networks.</td>
<td>test</td>
<td>Lecture</td>
<td>K2A_U09-11</td>
</tr>
</tbody>
</table>

18. Teaching modes and hours

Lecture / BA /MA Seminar / Class / Project / Laboratory

Sem 8: lecture - 15 h, laboratory - 15 h

19. Syllabus description:

Lecture:

Operational models of computer networks: basic laws for the resource utilization, throughput and response time. Definition of a network bottleneck. Queueing networks as a model of a communication network - 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. MVA
algorithm in analysis of TCP congestion avoidance mechanism and the transport time evaluation. Optimization of a "connection power" parameter. Investigation of TCP connection stability with the use of control theory approach.


Models of all optical networks routing, a model of electrical-optical edge router. Diffusion and fluid flow approximations in the analysis of transient states, application to the analysis of packet queues in IP routers, models of active queue management (e.g. random early deletion) in IP routers. Statistical properties of internet traffic (self-similarity, long term autocorrelation) and their influence on network performance.

**Laboratory:** Simple simulation queueing models and models of computer networks 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>
</tr>
<tr>
<td>6</td>
<td>Other</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total number of hours</td>
<td></td>
</tr>
</tbody>
</table>

24. **Total hours:** 30

25. **Number of ECTS credits:**

26. **Number of ECTS credits allocated for contact hours:**

27. **Number of ECTS credits allocated for in-practice hours (laboratory classes, projects):**

26. **Comments:**

Approved:

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