**COURSE SYLLABUS**

***DISTRIBUTED NETWORKS SYSTEMS***

**1. Program identification details**

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| 1.1 Higher education institution | „Ovidius” University of Constanta |
| 1.2 Faculty | Faculty Mathematics and Computer Science |
| 1.3 Department | Mathematics and Computer Science |
| 1.4 Field of studies | **Computer Science** |
| 1.5 Cycle of studies (degree) | Master |
| 1.6 Degree program/qualification | **Cyber Security and Machine Learning** |
| 1.7 Academic year | **2022-2023** |

**2. Course identification details**

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| --- | --- | --- | --- | --- | --- | --- | --- |
| 2.1 Course title | | | ***DISTRIBUTED NETWORKS SYSTEMS*** | | | | |
| 2.2 Course code | | | FMI.CSML.I.2.05 | | | | |
| 2.3 Instructor | | | **Assoc. Prof. Petac Eugen, Ph.D.** | | | | |
| 2.4 Teaching assistant | | | **Assoc. Prof. Petac Eugen, Ph.D.** | | | | |
| 2.5 Year | **I** | 2.6 Semester | **1** | 2.7. Evaluation type | **E** | 2.8 Course type \*/\*\* | **DAP/**  **DI** |

*\* DF – fundamental course, DD – field course, DS – specialty course, DC – complementary course, DAP – advanced study course, DSI – synthesis course, DCA – advanced knowledge course.*

*\*\* DI – mandatory course; DO – optional course.*

**3. Estimated workload (hours per semester)**

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| --- | --- | --- | --- | --- | --- | --- |
| 3.1 Number of teaching hours/week | | **3** | of which:  3.2 course | **1** | 3.3 applications*\*\*\** | **2** |
| 3.4 Total of teaching hours within the program/semester | | **56** | of which:  3.5 lecture | **28** | 3.6 applications | **28** |
| **3.7 Student workload for individual study** | | | | | | **108** |
| ***Distribution of workload*** | | | | | | [hours] |
| Individual study of texbooks, handbooks/reader, bibliography and notes | | | | | | 34 |
| Additional research (library, electronic resources, fieldwork) | | | | | | 33 |
| Homework (preparing seminar presentations, portfolios, critical essays, research papers, etc.) | | | | | | 24 |
| Individual consultations (optional) | | | | | | 10 |
| Evaluations / exams | | | | | | 7 |
| Other activities | | | | | | 0 |
| **3.8 Total hours per semester** | *56 + 108 = 164* | |  |  |  |  |
| **3.9 Number of credits** | 6 | |  |  |  |  |

*\*\*\* S - seminar; L - laboratory; P - project*

**4. Prerequisites (if any)**

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| 4.1 Curriculum-related | Undergraduate studies |
| 4.2 Skills-related | Computer Programming; Computer Networks |

**5. Requirements (if any)**

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| 5.1. For running the course | Classroom available |
| 5.2. For running the seminar / laboratory /project  *\*The type is to be chosen according to the discipline* | Laboratory room available with computers |

**6. Acquired specific skills**

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| Professional skills | Identification of basic concepts and models for distributed computing systems.  Identifying and explaining the basic architectures for distributed systems, as well as their specific technologies.  Modeling / virtualization of distributed systems. |
| Cross-cutting skills | Identifying the types and structure of distributed system models.  Arguing the choice of model type, depending on the interactions between the phenomena and the modeled processes.  Validation of communication models and their critical analysis by comparison with real distributed systems. |

**7. Course goal and objectives**

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| 7.1 The general objective of the course | Acquiring the basic knowledge regarding the distributed systems and their applications, in the real space as well as as an effect of their virtualization. |
| 7.2 Specific objectives | Completing the basic knowledge regarding the modeling of the processes specific to the distributed systems, with the complete and rigorous presentation of the results obtained in virtual environments. At the end of the course and laboratory classes, students will have acquired theoretical and practical knowledge related to: expertise and offering solutions in distributed systems; modern concepts on key issues related to information security management in distributed systems. |

**8. Contents**

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| **8.1 Lecture** | **Teaching methods** | **Number of hours** |
| 1. LAN and WAN fundamentals: Data link switching; The hierarchical model; Virtual Networks (VLAN-Virtual LAN); IPv4 and IPv6 addresses; The problem of routing in IP networks; TCP / UDP connections; Security solutions. | Dialog  Problematization  Active and interactive methods | 4 |
| 2. Virtualization: Presentation of the concept; Virtualization in cloud environments; Virtualization in Linux; Networks with VMware and VirtualBox; SDN. | 4 |
| 3.Middleware technologies: description, classification, distributed objects, structure of a Middleware platform, application distribution. Communication between processes. Remote Method Invocation - RMI; Remote Procedure Call – RPC. | 4 |
| 4. Peer-to-Peer (P2P) systems and applications - Features, applications, centralization issues, architectures (unstructured, structured, hierarchical), DHT-based applications, application development. | Interaction, problematization, argumentation  Synthesizing / essentializing information  Independent and cooperative learning | 4 |
| 5. Distributed RMI Programming - Remote Methode Invocation: Features, architecture presentation, RMI classes and interfaces, programming patterns, remote object activation, security managers. | 4 |
| 6. Development of distributed applications using CORBA technology: general aspects, architecture, specification of the functionality of a distributed application using CORBA technology, programming models. | 4 |
| 7. Mobile distributed systems: Platforms for mobile application development Android-based communication systems; Development of native applications and web applications for mobile devices; geolocation applications | 4 |
| **Bibliography:**  1. E. Petac, Retele si sisteme distribuite, Cap. 4, pp.103-206, in cartea Medii virtuale multimodale distribuite, autori Popovici D. M., Popa C., Nicola A., Petac E., Editura Universitaria Craiova şi Editura Prouniversitaria Bucuresti, 978- 606-26-0049-5, 2015, vol 4, 215 pag.  2. E. Petac – suport de curs.  3. D. Rene, A. Hassane, Discrete, Continuous and Hybrid Petri Nets, Springer-Verlag, 2005.  6. Wei-Meng Lee, Beginning Android 4 Application Development, Wrox, 2012.  7. E. Petac, T. Udrescu - Fundamente Java, Editura MatrixRom, Bucureşti, 2005.  8. A. Tanenbaum, Distributed Systems 3rd edition (2017)  9. A. D. Kshemkalyani, M. Singhal, Distributed ComputingPrinciples, Algorithms, and Systems, CAMBRIDGE UNIVERSITY PRESS. 2008.  10. J. Aspnes, Notes on Theory of Distributed Systems, 2019, http://cs-www.cs.yale.edu/homes/aspnes/classes/465/notes.pdf  11. M. van Steen, A.S. Tanenbaum, Distributed Systems, 3rd ed., distributed-systems.net, 2017.  13. Java Tutorial, https://docs.oracle.com/javase/tutorial/  14. Python tutorial, https://docs.python.org/3.7/tutorial/ | | |

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| **8.2 Applications\* (seminar / laboratory / project)**  *\*The type is to be chosen according to the discipline* | **Teaching methods** | **Number of hours** |
| 1. Distributed Networks and Systems - Virtual Solutions Based on Omnet ++ / NS-2 / NS-3 / Mininet Discrete Event Systems. | Dialog  Problematization  Active and interactive methods  Interaction, problematization, argumentation | 4 |
| 2. Communication between processes. Remote Method Invocation – RMI; Python / Java applications | 4 |
| 3. Remote Procedure Call - RPC (Remote Procedure Call) Python / Java applications. | 4 |
| 4. Dezvoltarea aplicatiilor P2P . Aplicatii Python/Java | 6 |
| 5. Development of native applications and web applications for mobile devices. | Synthesizing / essentializing information  Independent and cooperative learning | 4 |
| 6. Security of Distributed Systems: Fundamental concepts; Implementation solutions; Security audit of distributed systems. | 4 |
| 7. Presentation of the lab themes | 2 |
| **Bibliography:**  1. E. Petac, Retele si sisteme distribuite, Cap. 4, pp.103-206, in cartea Medii virtuale multimodale distribuite, autori Popovici D. M., Popa C., Nicola A., Petac E., Editura Universitaria Craiova şi Editura Prouniversitaria Bucuresti, 978- 606-26-0049-5, 2015, vol 4, 215 pag.  2. E. Petac – suport de curs.  3. D. Rene, A. Hassane, Discrete, Continuous and Hybrid Petri Nets, Springer-Verlag, 2005.  6. Wei-Meng Lee, Beginning Android 4 Application Development, Wrox, 2012.  7. E. Petac, T. Udrescu - Fundamente Java, Editura MatrixRom, Bucureşti, 2005.  8. A. Tanenbaum, Distributed Systems 3rd edition (2017)  9. A. D. Kshemkalyani, M. Singhal, Distributed ComputingPrinciples, Algorithms, and Systems, CAMBRIDGE UNIVERSITY PRESS. 2008.  10. J. Aspnes, Notes on Theory of Distributed Systems, 2019, http://cs-www.cs.yale.edu/homes/aspnes/classes/465/notes.pdf  11. M. van Steen, A.S. Tanenbaum, Distributed Systems, 3rd ed., distributed-systems.net, 2017.  13. Java Tutorial, https://docs.oracle.com/javase/tutorial/  14. Python tutorial, https://docs.python.org/3.7/tutorial/ | | |

**9. Correlation between the content of the course and the needs/expectations of the epistemic community, professional associations and/or significant employers relevant for the program**

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| Preparation of master students for a profession in the field of design, implementation and administration and security of distributed systems, in the field of IT&C or to meet the requirements of research or doctoral programs in computer science, applied computer science, applied mathematics, economics or engineering. |

**10. Evaluation**

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| Type of activity | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Percentage of final grade |
| 10.4 Course | Active participation in teaching activities  Understanding the course content and applying these concepts within the course project | Scoring course topics and answers  Written exam | 10%  50% |
| 10.5 Applications\*  Laboratory  *\*The type is to be chosen according to the discipline* | Active participation  Solving laboratory assignments | Marking the solutions of the laboratory assignments, sent according to the indicated term | 40% |
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| 10.6 Minimum standard of achievement for the acquisition of the ECTS credits | | | |
| Realization and presentation of a project on a specialized topic, from the area of distributed systems, in the context of the course program. | | | |

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| Date of completion  20.09.2022 | Course Instructor,    Assoc. Prof. Eugen PETAC, Ph.D | Teaching Assistant,,    Assoc. Prof. Eugen PETAC, Ph.D |

Date of approval in the Department Head of Department

27.09.2022 Assoc. Prof. Crenguța-Mădălina PUCHIANU, Ph.D

Dean,

Assoc. Prof. Aurelian NICOLA, Ph.D