

**SYLLABUS / FIȘA DISCIPLINEI**
**1. Information on the study programme / Date despre programul de studii**

1.1. Institution / Instituția de învățământ superior	Universitatea de Vest din Timișoara
1.2. Faculty / Facultatea	Matematică și Informatică
1.3. Department / Departamentul	Computer Science (Informatică)
1.4. Study program field	Computer Science (Informatică)
1.5. Study cycle/ Ciclul de studii	MSc / master
1.6. Study programme / Programul de studii / calificarea*	Artificial Intelligence and Distributed Computing

**2. Information on the course / Date despre disciplină**

2.1. Title of the course / Denumirea disciplinei		Multi-agent Systems					
2.2. Teacher in charge of the course / Titularul activităților de curs		Lecturer dr. Gabriel Iuhasz					
2.3. Teacher in charge of the seminar / Titularul activităților de seminar		Lecturer dr. Gabriel Iuhasz					
2.4. Study year / Anul de studii	I	2.5. Semester / Semestrul	2	2.6. Examination type / Tipul de evaluare: E(xam)/C(olloquim)	E	2.7. Course type / Regimul disciplinei: M(andatory)/ E(lective)/ F(acultative)	M

**3. Estimated study time (number of hours per semester) / Timpul total estimat (ore pe semestru al activităților didactice)**

3.1. Attendance hours per week / Număr de ore pe săptămână	3	out of which din care: 3.2 lecture/ curs	2	3.3. seminar/laborator	1
3.4. Attendance hours per semester / Total ore din planul de învățământ	42	out of which: 3.5 lecture / curs	28	3.6. seminar/laborator	14
<b>Distribution of the allocated amount of time / Distribuția fondului de timp*</b>					<b>hours/ore</b>
Individual study /Studiu după manual, suport de curs, bibliografie și notițe					40
Supplementary documentation at library or using electronic repositories / Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate					20
Preparing for laboratories, homework, reports etc. /Pregătire seminarii/laboratoare, teme, referate, portofolii și eseuri					40
Exams / Examinări					10
Tutoring / Tutorat					10
3.7. Total number of hours of individual study / Total ore studiu individual	120				
3.8. Total number of hours per semester / Total ore pe semestru	162				

3.9. Number of credits (ECTS) / Număr de credite	6
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**4. Prerequisites (if it is the case) / Preconțiții (acolo unde e cazul)**

4.1. curriculum / de curriculum	AI, Intelligent Systems
4.2. skills / de competențe	Java programming

**5. Requirements (if it is the case) / Conțiții (acolo unde e cazul)**

5.1. for the lecture / de desfășurare a cursului	Room with blackboard and video projector
5.2. for the seminar, laboratory / de desfășurare a seminarului/laboratorului	Laboratory with computers (Jade/Spade and Jess/Clips installed)

**6. Acquired skills / Competențe specifice acumulate**

Professional skills / Competențe profesionale	<ul style="list-style-type: none"> <li>- Ability to indentificate complex problems solving methods</li> <li>- Ability to analyse and design MAS applications</li> <li>- Ability to implement and validate MAS applications</li> </ul>
Transversal skills / Competențe transversale	<ul style="list-style-type: none"> <li>- Cappacity to comunicate knowledge about MAS</li> <li>- Capcity to apply knowledge in different domains</li> </ul>

**7. Objectives of the course / Obiectivele disciplinei (reieșind din grila competențelor specifice acumulate)**

7.1. General objective / Obiectivul general al disciplinei	<ul style="list-style-type: none"> <li>• Theoretical and experimental approach concerning parallel and distributed computing in Intelligent systems</li> <li>• Study of multi-agent models and architectures</li> </ul>
7.2. Specific objectives / Obiectivele specifice	<ul style="list-style-type: none"> <li>• Developing applications based on multi-agent models</li> </ul>

**8. Content / Conținuturi\***

8.1. Lecture / Curs	Teaching strategies / Metode de predare	Remarks, details / Observații
C1-2. Intelligent systems	University lecture, conversation, example	Bibliography presentation, and slides
C3. Distributed problem solving	University lecture, conversation, example	Including real life examples of distributed problem solving.
C4-5. Parallel algorithms in AI (Knowledge representation; Rules compilation; Reasoning).	University lecture, conversation, example	

C6. Agent based systems	University lecture, conversation, example	Presenting Reactive, Deliberative and Hybrid models
C7-9. Blackboard model (Distributed expert systems; Cooperation models; Classification of blackboard systems; Applications.	University lecture, conversation, example	Including Real life examples of blackboard systems.
C10-14. Multi-agent models (Foundations; Agents classification; Interaction and cooperation; Communication; Collaboration and coordination, Mobile agents, Security)	University lecture, conversation, example	Including modern agent based systems such as Serf and Consul from Hashicorp.

**Recommended bibliography / Bibliografie**

1. Michael Wooldridge - An Introduction to Multi - Agent Systems, John Wiley & Sons, 2009
2. F. Bellifemine, G. Claire, D. Greenwood – Developing Multi-Agent Systems with Jade, John Wiley & Sons' 2007
3. S.Russel, P. Norvig - Artificial Intelligence. A Modern Approach, second edition, Prentice Hall, 2010
4. J. Ferber - Les systemes multi-agents. Vers une intelligence collective, InterEditions, 1995
5. M. dInverno - Understanding Agent Systems, Springer Verlag, second edition, 2004
6. M. Singh and M. Huhns. Readings in Agents. Morgan-Kaufmann Publishers, 1997.
7. M. P. Singh - Multiagent Systems - A theoretical Framework for Intentions, Know-How, and Communications, Springer Verlag, 1994
8. J. M. Bradshaw - Software agents, MIT Press, 1997
9. G. Weiss, eds. Multi-Agent Systems. A modern approach to Distributed AI, The MIT Press, 1999.
10. G. F. Luger, W. A. Stubblefield - Artificial intelligence and the design of expert systems, Benjammin/Cummings Pbs., 2005
11. T. Ishida - Parallel, Distributed and Multiagent Production Systems, Springer Verlag, 1994
12. R. Englemore, T. Morgan - Blackboard systems, Addison Wesley, 1988
13. H. Kitano, J. A. Hendler - Massively Parallel Artificial Intelligence,
14. MIT Press, 1994
15. M. Watson - Intelligent Java applications for the Internet and intranets, Morgan Kaufmann, 1997 (sau versiunea in romana, ed. ALL, 1999)
16. M. Wooldridge, N. R. Jennings - Intelligent agents: Theory and practice, Knowledge engineering review, 1995
17. \*\*\* IEEE - Intelligent systems
18. \*\*\* Autonomous Agents and Multi-Agent Systems, Kluwer Academic Pbs.
19. J. Giarratano, G. Riley - Expert Systems: Principles and Programming, PWS Pbs. Comp., ITP, 4th

edition, 2005 20. Ernest Friedman-Hill - Jess in action. Java rule-based systems, Manning Publ. Co., 2003 21. <a href="http://www.ghg.net/clips/Version623.html">http://www.ghg.net/clips/Version623.html</a> 22. <a href="http://herzberg.ca.sandia.gov/jess/">http://herzberg.ca.sandia.gov/jess/</a> 23. <a href="http://myri1.ieat.ro/mas/">http://myri1.ieat.ro/mas/</a> ; <a href="http://www.cougaar.org/">http://www.cougaar.org/</a> 24. <a href="http://www.ai.sri.com/oaa/">http://www.ai.sri.com/oaa/</a> ; <a href="http://jade.tilab.com/">http://jade.tilab.com/</a>		
<b>8.2. Seminar, lab / Seminar, laborator</b>	<b>Teaching/learning strategies / Metode de predare/ învățare</b>	<b>Remarks, details / Observații</b>
Parallel algorithms and architectures for rule based systems  Expert systems / MAS developed on: Clips, Jess, FuzzyJess, GBB, BBClips, JADE, SpadeOAA, Cougaar etc.  As well as application specific distributed agent based software such as Serf and Consul developed by Hashicorp.		
<b>Recommended bibliography / Bibliografie</b> 1.		

**9. Correlations between the content of the course and the requirements of the IT field / Coroborarea conținuturilor disciplinei cu așteptările reprezentanților comunității epistemice, asociațiilor profesionale și angajatorilor reprezentativi din domeniul aferent programului**

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**10. Evaluation / Evaluare\***

Activity / Tip de activitate	10.1. Evaluation criteria / Criterii de evaluare**	10.2. Evaluation methods / Metode de evaluare***	10.3. Weight in the averaged mark / Pondere din nota finală
10.4. Lecture / Curs	Theoretical and practice knowledge evaluation	Write exam / Project / Report	50%
	Periodic evaluation	Tests, Home work	20%
10.5. Seminar/ lab	Labs and homework evaluation	Computer tests; Home work	30%

10.6. Minimal knowledge for passing / Standard minim de performanță

- Course: The capacity to understand basic concepts of MAS and the capacity to understand basic principles to implement MAS.
- Lab.: Middle level MAS problem solving

Date/ Data completării

Signature (lecture) /  
Semnătura titularului de curs  
Lect. Dr. Gabriel Iuhasz

Signature (seminar)  
Semnătura titularului de seminar  
Lect. Dr. Gabriel Iuhasz

Signature (director of the department)  
Semnătura directorului de departament  
Conf.dr. Victoria Iordan