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	Bachelor / licență
1.6. Study programme / Programul de studii / calificarea*	Computer Science / Informatică în limba engleză

2. Information on the course / Date despre disciplină

2.1. Title of the course / Denumirea disciplinei	Logic for Computer Science						
2.2. Teacher in charge of the course / Titularul activităților de curs	Conf. Dr. Adrian Crăciun						
2.3. Teacher in charge of the seminar / Titularul activităților de seminar	Conf. Dr. Adrian Crăciun/Lect.Dr. Mădălina Eraşcu						
2.4. Study year / Anul de studii	1	2.5. Semester / Semestrul	1	2.6. Examination type / Tipul de evaluare: E(xam)/C(olloquim)	E	2.7. Course type / Regimul disciplinei: M(andatory)/ E(lective)/ F(acultative)	DI

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	4	out of which din care: 3.2 lecture/ curs	2	3.3. seminar/laborator	2
3.4. Attendance hours per semester / Total ore din planul de învățământ	56	out of which: 3.5 lecture / curs	28	3.6. seminar/laborator	28

Distribution of the allocated amount of time / Distribuția fondului de timp*	**hours/ ore**
Individual study /Studiu după manual, suport de curs, bibliografie și notițe	56
Supplementary documentation at library or using electronic repositories / Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate	14
Preparing for laboratories, homework, reports etc. /Pregătire seminarii/laboratoare, teme, referate, portofolii și eseuri	56
Exams / Examinări	6
Tutoring / Tutorat	14

3.7. Total number of hours of individual study / Total ore studiu individual	140
3.8. Total number of hours per semester / Total ore pe semestru	206

3.9. Number of credits (ECTS) / Număr de credite	6

4. Prerequisites (if it is the case) / Precondiții (acolo unde e cazul)

4.1. curriculum / de curriculum	Basic knowledge of mathematics (naive set theory, functions)
4.2. skills / de competențe	High-school level math/problem solving skills.

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

5.1. for the lecture / de desfășurare a cursului	Online: Google Meet / Google Classroom (details pending)
5.2. for the seminar, laboratory / de desfășurare a seminarului/laboratorului	Online: Google Meet / Google Classroom (details pending)

6. Acquired skills / Competențe specifice acumulate

Professional skills / Competențe profesionale	**Cognitive:** understand the role reasoning (mathematics) plays in problem solving. Understand logic as application of reasoning to the problem of reasoning. Understand the role of language in problem solving. Syntax and semantics, the expressive power of a language. Understand the power and limitation and applications of propositional logic and predicate logic, respectively. Understand reasoning systems based on predicate logic, reasoning with equality, induction. **Technical:** Design and simplify digital circuits, apply resolution based methods to solve satisfiability problems. Use reasoning methods to solve problems (in particular proving methods). Implement reasoning methods for propositional and predicate logic. **Affective-cognitive:** Understand the role and use of reasoning in solving problems in different fields of computer science, and science in general.
Transversal skills / Competențe transversale	• Communicate, identify, apply and organize reasoning in different activity domains.

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

7.1. General objective / Obiectivul general al disciplinei	Introducing logic as a working language for solving problems in computer science and mathematics.
7.2. Specfic objectives / Obiectivele specifice	**Knowledge:** Describe the syntax and semantics of propositional logic, predicate logic. Describe semantical based problem solving and the difficulties represented by this approach. Describe reasoning systems in propositional and predicate logic. **Abilities:** Apply and implement reasoning in propositional logic (resolution based methods). Prove using reasoning systems for predicate logic, equality,

	induction. **Aptitudes:** Analyze a problem, identify a language that can express the problem and relevant knowledge, identify a reasoning system and attempt to solve the problem by reasoning.

8. Content / Conținuturi*

8.1. Lecture / Curs	**Teaching strategies / Metode de predare**	**Remarks, details / Observații**
L01. Motivation: logic, mathematics, computer science. What is mathematics. Reasoning. Properties of reasoning. What is (mathematical) logic?	Q&A/Lecture/Dialogue	Lecture materials available at http://staff.fmi.uvt.ro/~adrian.craciun/
L02. Logic and language. Models in logic. Logic motivated by mathematics. Logic motivated by computer science.	Q&A/Lecture/Dialogue	Lecture materials available at http://staff.fmi.uvt.ro/~adrian.craciun/
L03. Propositional logic. Informal description. Syntax, strict form, relaxed form. Parsing propositions	Q&A/Lecture/Dialogue	Lecture materials available at http://staff.fmi.uvt.ro/~adrian.craciun/
L04. Semantics of propositional logic. Truth values. Interpretations. Truth value under interpretation. Validity.	Q&A/Lecture/Dialogue	Lecture materials available at http://staff.fmi.uvt.ro/~adrian.craciun/
L05 Satisfiability. Truth tables. Propositional equivalence. A catalogue of equivalent formulae.Logical consequence.	Q&A/Lecture/Dialogue	Lecture materials available at http://staff.fmi.uvt.ro/~adrian.craciun/
L06. Deduction theorem. Applications: digital circuit design. Boolean functions. Complete sets of boolean	Q&A/Lecture/Dialogue	Lecture materials available at http://staff.fmi.uvt.ro/~adrian.craciun/

connectives.		
L07. Normal forms. Literals. Negation normal form. Transformation procedure. Conjunctive normal form. Disjunctive normal form. Transformations to normal form.	Q&A/Lecture/Dialogue	Lecture materials available at http://staff.fmi.uvt.ro/~adrian.craciun/
L08. Resolution. Clausal form. Correctness of a resolution step. Resolution algorithm. Correctness and completeness. Impovements: Davis Putnam (DP). Davis Putnam Logemann Loveland (DPLL).	Q&A/Lecture/Dialogue	Lecture materials available at http://staff.fmi.uvt.ro/~adrian.craciun/
L09. The relevance of predicate logic. Syntax. Substitutions.	Q&A/Lecture/Dialogue	Lecture materials available at http://staff.fmi.uvt.ro/~adrian.craciun/
L10. Semantics of predicate logic. Validity, satisfiability. Logical equivalence. Logical consequence. Logic equivalent formulas.	Q&A/Lecture/Dialogue	Lecture materials available at http://staff.fmi.uvt.ro/~adrian.craciun/
L11. Reasoning in predicate logic. Axioms. Inference rules. Proofs. Proof techniques.	Q&A/Lecture/Dialogue	Lecture materials available at http://staff.fmi.uvt.ro/~adrian.craciun/
L12. Definitions. Theories. Proving using equalities.	Q&A/Lecture/Dialogue	Lecture materials available at http://staff.fmi.uvt.ro/~adrian.craciun/
L13. Proving by induction.	Q&A/Lecture/Dialogue	Lecture materials available at http://staff.fmi.uvt.ro/~adrian.craciun/
L14. Case studies. Summary	Q&A/Lecture/Dialogue	Lecture materials available at

review.		http://staff.fmi.uvt.ro/~adrian.craciun/

Recommended bibliography / Bibliografie

- Adrian Crăciun – Logic for Computer Science. Lecture Notes. 2020 (Posted on the website)
- Mordechai Ben-Ari, Mathematical Logic for Computer Science. Second Revised Edition. Springer, 2001.
- Bruno Buchberger, Logic for Computer Science. Manuscript, Copyright Bruno Buchberger 1991. Folosit cu permisiunea autorului.
- Chin-Liang Chang, Richard Char-Tung Lee, Symbolic Logic anf Mechanical Theorem Proving. Academic Press, New York, London, 1973.
- Jean H. Gallier, Logic for Computer Science, Foundations of Automatic Theorem Proving, Copyright 2003, Jean H. Gallier.
- John Harrison, Handbook of Practical Logic and Automated Reasoning, Cambridge University.
- Daniel J. Velleman, How to Prove It: A Structured Approach, Second Edition, Cambridge University Press, 2006.

8.2. Seminar, lab / Seminar, laborator	**Teaching/learning strategies / Metode de predare/ invățare**	**Remarks, details / Observații**
S01-S03. Motivating examples, review of basic notions.	Summary of lecture materials. Presentation (by students). Dialogue.	Homeworks announced at http://staff.fmi.uvt.ro/~adrian.craciun/
S04-S14: Weekly homeworks – solutions. Corresponding to the content of the lecture.	Summary of lecture materials. Presentation (by students). Dialogue.	Homeworks announced at http://staff.fmi.uvt.ro/~adrian.craciun/

Recommended bibliography / Bibliografie

- Adrian Crăciun – Logic for Computer Science. Lecture Notes. 2020 (posted on the lecture's website).

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

Reasoning-based problem solving knowledge and skills are essential in any activity based on computer science, and this is particularly true for the IT industry.

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	10: excellent (outstanding performance with only minor errors), 8-9: very good (above the average standard but with some errors), 6-7: satisfactory (fair, but with significant shortcomings), 5: sufficient (performance meets minimum criteria), 0-4: fail (significant work has to be done)	Written exam	70%
10.5. Seminar/ lab	Regular homework. Optional work available: implementations of methods discussed.	Continuous evaluation.	40% 20%
10.6. Minimal knowledge for passing / Standard minim de performanță			
Basic knowledge of the concepts presented in the lecture: explain and apply. Minimal knowledge is measured by reaching the grade for passing the exam (5).			

Date/ Data completării
Sept 2020

Signature (lecture) /
Semnătura titularului de curs

Signature (seminar)
Semnătura titularului de seminar

Signature (director of the department)
Semnătura directorului de departament