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| **CMPE 583 Web Semantics** |
| **Department:** Computer Engineering  |
| **Instructor Information:****Name:** Assoc. Prof. Dr. Duygu Çelik Ertuğrul**E-mail:** duygu.celik@emu.edu.tr**Office:** CMPE 206**Office Tel:** 0 392 630 1178   |
| **Meeting times and places:**Wednesday 11:30-14:20, CMPE 236 |
| **Program Name:** Computer Engineering  | **Program** **Code:** 25 |
| **Course Code**CMPE 583 | **Credits** 3 | **Year/Semester**2018-2019 Fall |
| [ ]  Required Course [x]  Elective Course |
| **Prerequisite(s):** |
| **Catalog Description** Course will cover URI scheme; XML and processing; resource description framework (RDF): model, syntax, schema and languages; ontology concept, Web-based ontologies, integration and interoperability, semantics and abstract syntax of OWL, DAML; semantic grid concept and applications; Web services and agents; Semantic Web Services; Semantic Web Rule Language (SWRL), Semantic Query-Enhanced Web Rule Language (SQWRL) and applications; ontology parsing and reasoning; best practice case studies; W3 Consortium, current activities and future directions.**Aims & Objectives**This course aims to provide the basic overview of what the Semantic Web is and how it can be used. It mainly contains three parts: Semantic Web theory, ontology and its applications. The major part of the course is the Semantic Web languages and applications. It starts from XML and goes further to RDF and OWL. The ontology part contains ontology engineering and the survey of the most popular ontologies (or metadata). The application part shows some current trends and semantic related expert knowledgebase system applications. |
| **Course Web Page**https://staff.emu.edu.tr/duygucelik/en/teaching/cmpe583 |
| **Textbook(s):**Recommended books for this course:* Daconts, M.C., L.J. Orbst, and K.T. Smith. 2003. The Semantic Web: A Guide to the Future of XML, Web Services, and Knowledge Management. New York: Wiley. [ISBN: 0-471-43257-1]
* Antoniou, G. and F. van Harmelen. 2004. A Semantic Web Primer. Cambridge, MA: MIT Press. [ISBN: 0-262-01210-3]
* G. Antoniou, P. Groth, F. Harmelen and R. Hoekstra. A semantic Web Primer. The MIT Press, 2012.
* Powers, S. 2003. Practical RDF. Sebastopol, CA: O'Reilly.[ISBN: 0-596-00263-7](One copy is reserved at IU Library Media & Reserve Service Department (http://www.libraries.iub.edu/index.php?pageId=307) under Prof. Ding's personal reservation)
* Semantic University, <https://www.cambridgesemantics.com/blog/semantic-university/>
* M. P. Singh, and M. H. Huhns. Service-Oriented Computing: Semantics, Processes, Agents. John Wiley & Sons, 2005.
* B. DuCharme. Learning SPARQL, O´Reilly, 2011
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| **Indicative Basic Reading List:*** Davies, J., D. Fensel and F. van Harmelen, eds. 2003. Towards the Semantic Web: Ontology-Driven Knowledge Management. New York: Wiley.
* Gomez-Perez, A., M. Fernandez-Lopez, and O. Corcho. 2003. Ontological Engineering: Advanced Information and Knowledge Processing. Berlin: Springer.
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| **Topics Covered and Class Schedule (3 hours of lectures per week)**

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| **Week 1** | Chapter 1: Today’s Web and the Semantic WebChapter 2: The Business Case for the Semantic Web |
| **Week 2** | Chapter 3: Understanding XML and its Impact on the EnterpriseChapter 4: Understanding XML Related Technologies |
| **Week 3** | Chapter 5: Understanding Resource Description Framework (RDF) |
| **Week 4** | Chapter 6: Understanding TaxonomiesChapter 7: Understanding Ontology |
| **Week 5** | Chapter 8: SWRL & SQWRL and Reasoning (based on the rules by using Ontology Reasoners: Hermit, Race Pro, Pellet etc. on Protégé). |
| **Week 6** | **Class Exercise: Ontology generating by using Protégé 5.x** **Class Exercise: Rule Knowledgebase generating based on SWRL/SQWRL****Class Exercise: Semantic Web Programming via Java by using Ontology Parser and Reasoner by using Ontology APIs tools** |
| **Week 7**  | **\*Assignment Stage 1: %10 (Create Ontology on Protégé editor +Presentation) will be** **Week 7: 07 November 2018** |
| **Week 8**  | **\*Assignment Stage 2: %10 (Create Rules by using SWRL/SQWRL +Presentation) will be** **Week 8: 14 November 2018** |
| **Week 9**  | **MIDTERM EXAM** |
| **Week 10** | **MIDTERM EXAM** |
| **Week 11** | Chapter 9: SPARQL |
| **Week 12** | Chapter 10: Understanding Web ServicesChapter 11: Semantic Web Services Chapter 12: An Organization’s Roadmap to Semantic Web |
| **Week 13** | **\*Assignment Stage 3: %15 (Coding "An Ontology Parser/Inferencing Engine" with Java by using OWL API & a Pellet Reasoner API & SWRLAPI + Presentation) will be** **Week 13: 19 December 2018** |
| **Week 14** | **\*Assignment Stage 4: %15 (Final Report (article format) + Presentation) will be** **Week 14: 26 December 2018***Students will prepare an article report and demonstrate/run their program. The article format will be* [*IEEE Word format*](http://ieeeauthorcenter.ieee.org/wp-content/uploads/Transactions-template-and-instructions-on-how-to-create-your-article.doc). |
| **Week 15** | **FINAL EXAM** |

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| **Some well-known semantic web programming tools will be used during class exercises (Find them in the CODING-TOOLS-PACK folder):*** netbeans-8.2-windows
* owlapi-3.x / owlapi-4.x / owlapi-5.x
* Protege-5.2.0-win
* swrlapi-master
* pellet-owlapi.jar or pellet-master

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| **Weeks 5-6** | Introduce Protégé 5 editor and other Semantic Web tools. |
| **Weeks 6-7** | Developing an ontology. |
| **Weeks 7** | Creating a decision table for generating SWRL and SQWRL rules of the application.  |
| **Weeks 9-10** | Using NetBeans 8.x Java Framework for Semantic Web Programming. Students will use some well-known Ontology Parser APIs and Ontology Reasoner APIs for managing their ontologies. This exercise will involve Database, GUI/Web/Mobile applications, Ontology to create an Expert Knowledgebase System application. |

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| **Course Learning Outcomes:*** Understand the rationale behind Semantic Web.
* Model ontologies using Resource Description Framework (RDF).
* Design RDF Schemas for ontologies.
* Model and design ontologies using Web Ontology Language (OWL).
* Model and design ontology rules using Semantic Web Rule Language (SWRL and SQWRL).
* Query ontologies using SPARQL.
* Understand and reflect on the principles of Ontology Engineering.
* Make an association between Semantic Web and Web 2.0.
* Apply Semantic Web technologies to real world applications such as Expert Rule-based Knowledgebase System application.
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| **Assessment** | **Method** | **No** | **Percentage** |
| Midterm Exam(s) | 1 | 20 % |
| Final Examination | 1 | 30 % |
| Attendance | - | 0 % |
| Assignment | 1 (4 phases) | 50 % |
| **Attendance grade:** No grade will be given. However, compulsory for weekly design studio meetings. |
| **Policy on makeups:** For eligibility to take a makeup exam, the student should bring a doctor's report within 3 working days of the missed exam. |
| **Policy on the NG grade:** If you miss two exams with no valid excuse, you will be given the NG grade. |
| **Policy on missed labs:** There will be no makeup for missed labs. If you cannot attend a lab for some reason, you should contact the assistant *beforehand* so that you can present your work in advance. |
| **Relationship of the course to Program Outcomes**

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| **CLO No.** | **Course Learning Outcome / Performance Indicator** | **Contribution to student outcome** **(if any)** | **Achievement Level 4 (Excellent)** | **Achievement Level 3** **(Good)** | **Achievement Level 2** **(Below expectations)** | **Achievement** **Level 1** **(Much below expectations)** |
| 1 | Learn the fundamental concepts, advantages and limits of the semantic web (SW). |  | Understand all the fundamental concepts, advantages and limits of the SW well. | Understand most of the fundamental concepts, advantages and limits of the SW. | Understand some of the fundamental concepts, advantages and limits of the SW. | Low level of knowledge about the fundamental concepts, advantages and limits of the SW. |
| 2 | Learn main differences between Web 1.0/Web 2.0 and semantic web (Web 3.0). |  | Understand all differences between Web 1.0/Web 2.0 and semantic web (Web 3.0) well. | Understand most of the differences between Web 1.0/Web 2.0 and semantic web (Web 3.0). | Understand some of the differences between Web 1.0/Web 2.0 and semantic web (Web 3.0). | Low level of knowledge about the differences between Web 1.0/Web 2.0 and semantic web (Web 3.0). |
| 3 | Learn Ontologies, Its Types, Its W3C Standards, Ontology Languages, And Ontology Application Areas.  |  | Knows the ontologies, its structures, its W3C standards, associated underlying technologies (XML, RDF, OWL, etc.), its types and application areas well. | Knows the ontologies, its structures, its W3C standards, associated underlying technologies (XML, RDF, OWL, etc.), its types and application areas. | Knows the ontologies, its structures, its W3C standards, associated underlying technologies (XML, RDF, OWL, etc.), its types and application areas partially. | Low level of knowledge on the ontologies, its structures, its W3C standards, associated underlying technologies (XML, RDF, OWL, etc.), its types and application areas. |
| 4 | Learn RDF Framework and Associated Technologies. |  | Knows the RDF framework and its extended technology RDFs well. | Knows the RDF framework and its extended technology RDFs. | Knows the RDF framework and its extended technology RDFs partially. | Low level of knowledge on the RDF framework and its extended technology RDFs. |
| 5 | Learn Querying Ontologies. |  | Knows creating ontologies (using Protégé editor) and querying ontologies via SPARQL well.  | Knows creating ontologies (using Protégé editor) and querying ontologies via SPARQL. | Knows creating ontologies (using Protégé editor) and querying ontologies via SPARQL partially. | Low level of knowledge on creating ontologies (using Protégé editor) and querying ontologies via SPARQL. |
| 6 | Learn modeling and designing ontology rules by using Semantic Web Rule Language (SWRL and SQWRL). |  | Can create SWRL/SQWRL rules by using Protégé tool and then can develop a reasoner with Java by using ontology APIs for ontology parsing and ontology reasoning well. | Can create SWRL/SQWRL rules by using Protégé tool and then can develop a reasoner with Java by using ontology APIs for ontology parsing and ontology reasoning partially. | Can create some parts of the SWRL/SQWRL rules by using Protégé tool and then can develop limited parts of the reasoner with Java by using ontology APIs for ontology parsing and ontology reasoning | Underachievement while creating semantic rules on Protégé editor and reasoning the ontology by using ontology APIs for ontology parsing and ontology reasoning. |
| 7 | Design and Develop an Expert Rule-based Knowledgebase Software System (as real-world applications) by applying Semantic Web technologies for term Project | d,j1,j2 | Excellent Project | Good Project | Average Project | Underachievement in the Project |
| 8 | Write Final Report/Article for the Project | g1,g2 | Excellent Report | Good Report | Average Report | Weak Report |
| 9 | Make 4 Presentations for the project with demo | g1, g2 | Excellent Presentation | Good Presentation | Average Presentation | Weak Presentation |
| The contribution of each course learning outcome to student outcomes is specified in parenthesis. The studentoutcomes are available at <http://cmpe.emu.edu.tr/abet> |

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| **Prepared by:** Assoc.Prof. Dr. Duygu Çelik Ertuğrul | **Date Prepared:** 27 July 2018 |