SER 531 Semantic Web Engineering
Course Syllabus

1. Contact Information

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Course Website: Canvas

Office Hours
Tuesday & Thursday: 12pm to 1:30pm; or by appointment
Location: Peralta 230D
Zoom link: https://asu.zoom.us/my/drbansal
Contact instructor via email to make an appointment.

2. Course Objectives and Expected Learning Outcomes

Catalog Description: State-of-the-art semantics-based approaches and tools that can be leveraged to enrich and enhance today's big data. Covers approaches to ontology engineering, searching and filtering relevant information, representing big data, modern applications of these methods and techniques for Web-based intelligent applications and services. Discusses applications of semantic technology that could improve the processing of big data.

Course Description: In this course students will be introduced to the Semantic web vision, state-of-the-art semantics-based approaches and tools that can be leveraged to enrich and enhance today's big data. Ontology languages (RDF, RDF-S, & OWL) and technologies (explicit metadata, ontologies, logic, and inference) are central to Semantic Web development. Students will be exposed to ontology engineering, ontology alignment & matching, searching and filtering relevant information, extracting and reasoning, representing big data, modern applications of these methods and techniques for Web-based intelligent applications and services. Students will also be exposed to Semantic Web Query Languages and Description Logic that provide theory and systems for expressing structured knowledge and for accessing and reasoning with it in a principled way. Students will be introduced to latest research in the area of Linked Data, Linked open data cloud, Big data integration, semantic querying of Big data, semantics-based analysis for Web application, Question Answering over Linked Data, Semantic computing for Smart cities.

Pre-requisites: Knowledge of Java programming.

Student Learning Outcomes:

Students completing SER531 will be able to:

- Describe the underlying ideas of Semantic web and its layered architecture
- Explain concepts of metadata, semantics of knowledge and resource, ontology, and their description in XML-based syntax and Web Ontology Language (OWL)
- Critically assess the adequacy of relevant semantic web standards (XML, RDF, OWL, SPARQL, etc.) as a basis for building practical systems.
- Apply ontology engineering approaches in semantic applications
- Create knowledge-based models for urban domains and applications using semantic web technologies.
- Analyze application cases in big data integration, data exchange, knowledge management, e-learning, and web services
- Discuss the methodologies in ontology engineering and research issues in semantic computing and semantic data integration

3. Grading Policies

Assessment Type	Weight
Quizzes	5%
HW Assignments	20%
Mid-term test	15%
Final exam	20%
Course Project	40%
Total	100%

All assignments must be submitted via Canvas.

Grading scale: TBD

4. Absence & Make-Up Policies

Notify the instructor BEFORE an assignment is due if an urgent situation arises and the assignment will not be submitted on time. Published assignment due dates (Arizona Mountain Standard time) are firm. You can contact your instructor (early in the semester) for accommodation on the following:

- excused absences related to religious observances/practices that are in accord with ACD 304–04, "Accommodation for Religious Practices"
- excused absences related to university sanctioned events/activities that are in accord with ACD 304–02, "Missed Classes Due to University-Sanctioned Activities"
- excused absences related to missed class due to military line-of-duty activities that are in accord with ACD 304–11, "Missed Class Due to Military Line-of-Duty Activities," and SSM 201–18, "Accommodating Active Duty Military"

Alternative arrangements will generally be made for any examinations and other graded in-class work affected by such absences. Students who request an excused absence must follow the

policy/procedure guidelines. Excused absences do not relieve students of responsibility for any part of the course work required during the period of absence

5. Readings, Assignments, Examinations, Special Materials, Required Activities

Reference Books (optional):

- A Semantic Web Primer by Grigoris Antoniou, Frank van Harmelen;
  Publisher: The MIT Press; 3rd edition.
- Linked Data: Evolving the Web into a Global Data Space by Heath, T., & Bizer, C. (2011).
  Publisher: Morgan & Claypool.
- Semantic Web for the working ontologist by Allemang, D., & Hendler, J. (2011).
  Publisher : 2nd Edition, Morgan & Kaufmann [ISBN:978-0-12-385965-5]
- Semantic Web Programming by John Hebeler, Matthew Fisher, Ryan Blace, Andrew Perez-Lopez; Publisher: Wiley; ISBN-10: 047041801X | ISBN-13: 978-0470418017

Other Resources: Here are some recommended tools for use in this class.

- Protégé: An excellent ontology editor (http://protege.stanford.edu/)
- Fact++: A GPL-licensed OWL-DL reasoner (http://owl.man.ac.uk/factplusplus/)
- Jena - A Java framework for building Semantic Web applications. Includes RDF and OWL APIs, and the ability to read/write RDF/XML into these APIs (http://jena.apache.org/)
- Other resources will be provided as needed in class

Course Schedule (Tentative):

Week #	Lecture Content
Week 1	Semantic Web – Introduction and Vision
Week 2	Structured Web Documents
Week 3	Resource Description Framework – RDF & RDF-S
Week 4	Web Ontology Language – OWL and OWL2
Week 5	Discovering Information – Querying (RQL, SPARQL)
Week 6	Ontology Engineering (Protégé, Protégé OWL API)
Week 7	Linked data – publishing and linking
Week 8	Big Data integration; Ontology Similarity
Week 9	Building Semantic Web Applications (Apache Jena Framework)
Week 10	Description Logic
Week 11	Reasoning (Fact++); Rules (SWRL)
Week 12	Semantic Web Applications (E-learning, Web services)
Week 13	Question Answering using Linked Data
Week 14	Semantic Big Data querying (storage and processing)
Week 15	Linked data in Education

6. Classroom Behavior

Students in this class are expected to acknowledge and embrace the FSE student professionalism expectation located at: https://engineering.asu.edu/professionalism/

- Cell phones must be turned off/silent during class to avoid causing distractions. The use of recording devices is not permitted during class. Any violent or threatening conduct by an ASU student in this class will be reported to the ASU Police Department and the Office of the Dean of Students.
- Students are expected to participate in the educational process and not be a disruptive element with regard to the learning of others. Safety, self-discipline and respect for others are necessary elements in the educational processes employed in this course. All students should be familiar with the Student Code of Conduct, which can be found at http://www.asu.edu/studentlife/judicial/.
- Ample time will be provided to complete homework assignments. The assignments should be turned in by the specified deadline. Late assignments will not be accepted unless prior arrangements have been made with the instructor. The only legitimate reasons are business or university related travel or illness for more than half the assignment period with appropriate documentation.
- It is the student's responsibility to keep a backup of all your assignments and projects.
- Feedback on assignments will be provided within 2 weeks of submission. Students have the right to appeal a grade in writing. Submit your typed appeal with the graded item, stating the reason for your appeal. All appeals must be turned in no later than one week after the material has been returned in class.
- Any students who need special needs or accommodations in this course are encouraged to communicate these as soon as possible to make appropriate arrangements for these accommodations.

Communication

Communicating with the Instructor outside class: This course uses Slack Channel for general questions about the course. Prior to posting a question, please check the syllabus, announcements, and existing posts. If you do not find an answer, post your question in the relevant channel on Slack. You are encouraged to respond to the questions of your classmates. Email questions of a personal nature to your instructor or assigned TA. You can expect a response within 48 hours.

Email and Internet: ASU email is an official means of communication among students, faculty, and staff. Students are expected to read and act upon an email in a timely fashion. Students bear the responsibility of missed messages and should check their ASU-assigned email regularly.

All instructor correspondence will be sent to your ASU email account.

Course Time Commitment: This three-credit course requires approximately 135 hours of work. Please expect to spend around 9 hours each week preparing for and actively participating in this course.

Late or Missed Assignments: Notify the instructor BEFORE an assignment is due if an urgent situation arises and the assignment will not be submitted on time. Published assignment due dates (Arizona Mountain Standard time) are firm. Please follow the appropriate University policies to request an accommodation for religious practices or to accommodate a missed assignment due to University-sanctioned activities. Assignments submitted within 24 hrs. of the original published deadline will be considered with a 20% late penalty. Submissions submitted after 24 hrs. of the published deadline WILL NOT be considered.

Submitting Assignments: All assignments, unless otherwise announced, MUST be submitted to the designated area of Canvas. Do not submit an assignment via email.

Drop and Add Dates/Withdrawals: This course adheres to a compressed schedule and may be part of a sequenced program, therefore, there is a limited timeline to drop or add the course. Consult with your advisor and notify your instructor to add or drop this course. If you are considering withdrawal, review the following ASU policies: Withdrawal from Classes, Medical/Compassionate Withdrawal, and a Grade of Incomplete.

Grade Appeals: Grade disputes must first be addressed by discussing the situation with the instructor. If the dispute is not resolved with the instructor, the student may appeal to the department chair per the University Policy for Student Appeal Procedures on Grades.

Student Conduct: Students are entitled to receive instruction free from interference by other members of the class. An instructor may withdraw a student from the course when the student's behavior disrupts the educational process per Instructor Withdrawal of a Student for Disruptive Classroom Behavior.

Appropriate online behavior (also known as netiquette) is defined by the instructor and includes keeping course discussion posts focused on the assigned topics. Students must maintain a cordial atmosphere and use tact in expressing differences of opinion. Inappropriate discussion board posts may be deleted by the instructor.

The Office of Student Rights and Responsibilities accepts incident reports from students, faculty, staff, or other persons who believe that a student or a student organization may have violated the Student Code of Conduct.

7. Academic Integrity

Students in this class must adhere to ASU's academic integrity policy, which can be found at https://provost.asu.edu/academic-integrity/policy). Students are responsible for reviewing this policy and understanding each of the areas in which academic dishonesty can occur. In addition,

all engineering students are expected to adhere to both the ASU Academic Integrity Honor Code and the Fulton Schools of Engineering Honor Code. All work submitted for the course cannot have been submitted for any other course or any previous section of this same course. Student academic integrity violations are reported to the Fulton Schools of Engineering Academic Integrity Office (AIO). Withdrawing from this course will not absolve you of responsibility for an academic integrity violation and any sanctions that are applied. The AIO maintains a record of all violations and has access to academic integrity violations committed in all other ASU college/schools. Unless explicitly allowed by your instructor, the use of generative AI tools on any course assignment or exam will be considered academic dishonesty and a violation of the ASU Academic Integrity Policy. Students confirmed to be engaging in non-allowable use of generative AI will be sanctioned according to the academic integrity policy and FSE sanctioning guidelines.

Specific academic integrity rules for this class are: The Student Academic Integrity Policy of Arizona State University requires each student to act with honesty and integrity and to respect the rights of others in carrying out all academic assignments. There are a number of actions that constitute a violation of the policy. These actions in this course include, but are not limited to:

1) practicing any form of academic deceit;

2) referring to materials or sources or employing devices (e.g., audio recorders, crib sheets, calculators, solution manuals, or commercial research services) not specifically authorized by the instructor for use during tests, quizzes, homework, and class activities;

3) acting as a substitute for another person in any academic evaluation or using a substitute in any academic evaluation;

4) possessing, buying, selling, or otherwise obtaining or using, without appropriate authorization, a copy of any materials intended to be used for academic evaluation in advance of its administration;

5) depending on the aid of others to the extent that the work is not representative of the student's abilities, knowing or having good reason to believe that this aid is not authorized by the instructor;

6) providing inappropriate aid to another person, knowing or having good reason to believe the aid is not authorized by the instructor;

7) submitting the ideas or work of another person or persons without customary and proper acknowledgment of sources (i.e., engaging in plagiarism);

8) permitting one's own ideas or work to be submitted by another person without the instructor's authorization; or attempting to influence or change any academic evaluation or record for reasons having no relevance to class achievement.

9) turning in work/code done by someone else or another pair/group

10) copying work/code done by someone else or another pair/group

11) writing code together with someone else or with another pair/group (unless expressly allowed by the instructor)

A common question in programming courses is the use of code that is googled or found on popular sites such as StackOverflow. Items 5 and 7 pertain to this situation. Most programmers use reference examples, found in print or online. This is fine as a practice but is not acceptable in situations where you are using code to proxy your understanding of the coding concepts applied in that assessment (i.e. lab or in-class activity). First, if you are uncertain if it is allowable or not, verify directly with the instructor before submitting the assignment. Second, if it is allowable, you are still required to a) adhere to all originating author's constraints on the use and licensing of the code, and b) provide proper attribution (full URL to the code snippet or bibliographic reference to a print item). Failure to do so constitutes a violation of this Academic Integrity Policy.

Students may be allowed to work in small teams on lab and in-class assessments. You are to work with your partners and only your partners as directed by the instructor; receiving assistance from anyone else other than your partners, the graders, teaching assistants, approved tutors or the instructor is considered a violation of this Academic Integrity Policy. Further, on any paired/group assessments you remain individually responsible for the entire solution you must understand it fully, and there will be no differentiated grades awarded between the individuals in the pair/group. From an ethics standpoint, you have a professional responsibility to your partner to give your best effort on each programming assignment. Failure to do so will be considered an ethics violation.

The penalty for an Academic Integrity Violation (cheating) on an in-class assessment or lab will be a reduction of a course letter grade for the first offense, and failure of the course for a second offense. The penalty for an Academic Integrity Violation (cheating) on an exam is immediate failure of the course. The penalty for an ethics violation will be a zero for the in-class assessment or lab. All violations will be referred to the Dean's Office of the Ira A. Fulton Schools of Engineering.

Students should not release (to GitHub, friends, etc.) any of their completed assignments, in order to ensure that they do not cause an AIP violation during a future semester. If a student in a later class submits your work, you and they will be held accountable.

Copyright:
All course content and materials, including lectures (Zoom recorded lectures included), are copyrighted materials and students may not share outside the class, upload to online websites not approved by the instructor, sell, or distribute course content or notes taken during the conduct of the course (see ACD 304–06, "Commercial Note Taking Services" and ABOR Policy 5-308 F.14 for more information).

You may not post any course material (including but not limited to slides, exercises, and assignments), even excerpts, to an external site without the instructor's written permission. If this occurs, you may be penalized for Academic Dishonesty or IP infringement.

You must refrain from uploading to any course shell, discussion board, or website used by the course instructor or other course forum, material that is not the student's original work, unless the students first comply with all applicable copyright laws; faculty members reserve the right to delete materials on the grounds of suspected copyright infringement.

8. **Policy against threatening behavior, per the Student Services Manual, SSM 104–02**

Students, faculty, staff, and other individuals do not have an unqualified right of access to university grounds, property, or services (see SSM 104-02). Interfering with the peaceful conduct of university-related business or activities or remaining on campus grounds after a request to leave may be considered a crime. All incidents and allegations of violent or threatening conduct by an ASU student (whether on-or off-campus) must be reported to the ASU Police Department (ASU PD) and the Office of the Dean of Students

9. **Disability Accommodations**

Suitable accommodations are made for students having disabilities. Students needing accommodations must register with the ASU Student Accessibility and Inclusive Learning Services office and provide documentation of that registration to the instructor. Students should communicate the need for an accommodation in enough time for it to be properly arranged. See ACD 304-08 Classroom and Testing Accommodations for Students with Disabilities.

10. **Harassment and Sexual Discrimination**

Arizona State University is committed to providing an environment free of discrimination, harassment, or retaliation for the entire university community, including all students, faculty members, staff employees, and guests. ASU expressly prohibits discrimination, harassment, and retaliation by employees, students, contractors, or agents of the university based on any protected status: race, color, religion, sex, national origin, age, disability, veteran status, sexual orientation, gender identity, and genetic information.

Title IX is a federal law that provides that no person be excluded on the basis of sex from participation in, be denied benefits of, or be subjected to discrimination under any education program or activity. Both Title IX and university policy make clear that sexual violence and harassment based on sex is prohibited. An individual who believes they have been subjected to sexual violence or harassed on the basis of sex can seek support, including counseling and academic support, from the university. If you or someone you know has been harassed on the basis of sex or sexually assaulted, you can find information and resources at https://sexualviolenceprevention.asu.edu/faqs.

Mandated sexual harassment reporter: As an employee of the University I am considered a mandated reporter and therefore obligated to report any information regarding alleged acts of sexual discrimination that I am informed of or have a reasonable basis to believe occurred.

ASU Counseling Services, https://eoss.asu.edu/counseling, is available if you wish to discuss any concerns confidentially and privately.

11. **Photo requirement**

Arizona State University requires each enrolled student and university employee to have on file with ASU a current photo that meets ASU's requirements (your "Photo"). ASU uses your Photo

to identify you, as necessary, to provide you educational and related services as an enrolled student at ASU. If you do not have an acceptable Photo on file with ASU, or if you do not consent to the use of your Photo, your access to ASU resources, including access to classes (online or in person) may be negatively affected or denied.

12. Syllabus Disclaimer

Notice: **Any information in this syllabus (other than grading and absence policies) may be subject to change with reasonable advance notice.**

The syllabus is a statement of intent and serves as an implicit agreement between the instructor and the student. Every effort will be made to avoid changing the course schedule but the possibility exists that unforeseen events will make syllabus changes necessary. Please remember to check your ASU email and the course site often.