Instructor: Dr. Marcia Silva, Ph.D., msilva@uwm.edu, School of Freshwater Sciences

Class Meeting time & location: Fridays from 1 pm to 4 pm, UWM Water Technology Accelerator (WaTA) – Global Water Center – Conference Room 710. This is a face-to-face formatted course. Students will meet in the classroom all weeks at the scheduled time. Students can expect some lecture material will be posted online (UWM D2L), so that more discussion and hands-on activities can take place in the WaTA laboratories.

Most weeks, the first hour will be used for lectures of new material and presentations by students, while the subsequent three hours will be spent with hands-on activities and data analysis for student’s reports.

Prerequisites: Undergraduate students.

Course Description: The course will provide students with basic understanding of and skills related to characterization of materials and surfaces. Emphasis will be placed on performance of hands-on experiments on a variety of advanced equipment for materials characterization, such as gas adsorption analysis, Zetasizer, FTIR, Raman, microscopes, thermal analyzer and equipment for metal oxide deposition. At the end of this course, the student should (1) be able to describe a variety of experimental methods and identify when they should be applied, (2) be able to design experiments, based on this knowledge, (3) identify the limitations of a specific characterization method and understand how different characterization methods complement each other, (4) become familiar with modern methods of materials characterization, similar to those encountered in industrial and testing facilities, and government laboratory, (5) communicate effectively their results and findings through reports and orally.

Learning Outcomes:

1. An understanding of the methods used to characterize different surface properties and the strengths and weaknesses of each method.
2. Use of comparative analytical processes to derive information to meet the aims of each project.
3. Development of presentation and communication skills.
Course Structure:

Note while effort has been taken to make this syllabus an accurate reflection of the course material, Changes to its content are possible throughout the semester.

Week 1, Sep 08 - Introduction of Materials Sciences in Water Technology and Safety
Week 2, Sep 15 - Chemical building blocks and preparation of solutions
Week 3 and 4, Sep 22 and Sep 29 - Colloid and Surface Chemistry
    Malvern Zetasizer- zeta potential and particle size
Week 6, Oct 6 - Synthesis of Nanometer-Size Nanoparticles
    Synthesis and Characterization of Silver Nanoparticles or synthesis and Characterization of Graphene Oxide
Week 7, Oct 13 - Ultracentrifugation applied to particle characterization
    Preparation of carbon nanotube with centrifugation and ultracentrifugation – carbon nanotube preparation
Week 8, Oct 20 – Gas sorption – Surface Area & Pore Size Analysis
    Characterization of porous particles
Weeks 9, 10, 11 and 12, - Introduction to Microscopic and Spectroscopic Methods
    FTIR – Week 9 – Oct. 27
    Raman – Week 10 – Nov. 3
    Confocal Scanning Microscope – Week 11 and 12 – Nov. 10 and Nov. 17
    [Nov. 22-26 – Thanksgiving Recess]
Week 13, Dec. 1 - Thermal analysis
    DTG and TGA
Week 14, Dec. 8- Methods for metal oxide deposition
    Plasma etching and spin coating
Week 15, Dec. 15 Methods for metal oxide deposition (cont’d)
    Sputtering, E-beam evaporation, thermal evaporation– Basic concepts and demonstration in class.
Finals Week – Dec. 18 -22: Final Report due

Credits & Time Commitment:
This is a 3 credit-hour course. Students are expected to devote approximately 9 hours per week to the course over the semester. This time commitment will include:

In-class time – lectures and class discussions/activities – 45 hrs
Reading and study of assigned materials – 30 hrs
Preparation of Reports – 45 hrs
Preparation of lab notebook –15 hrs
Topics Presentations – 10 hrs

Evaluation:
Final course grade will be a result of participation in class activities, performance in reports, preparation and organization of lab notebook, topics presentations. No makeup assignments are anticipated.
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<thead>
<tr>
<th>Assessment</th>
<th>Undergraduate</th>
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<tbody>
<tr>
<td>Class participation/discussion</td>
<td>150</td>
</tr>
<tr>
<td>Reports</td>
<td>250</td>
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<tr>
<td>Presentations</td>
<td>250</td>
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<tr>
<td>Lab notebook</td>
<td>150</td>
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<td>800</td>
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Course Grade Scale: 93---100% A; 90-92% A-; 87-89% B+; 83-86% B; 80-82% B-
77-79% C+; 73-76% C; 70-72% C-; 67---69% D+; 63-66% D; 60-62% D-; <60% F

*Participation and Discussion* - grades will be a result of student’s engagement in class discussions and participation during in-class group and lab work.

*Research Reports* – Preparation of a comprehensive, well-documented and appropriately referenced written research report is expected upon completion of each laboratory class and is due at the beginning of the following class. Guidelines on how to prepare a professional-style research report will be provided.

*Topics Presentations* – On two occasions in the semester, each student will present the theory and methods related to a particular analysis and the information in associated peer-reviewed articles related to the topic. Students will present visual based presentation (e.g. power point) their researched information in a 30-min lecture to the class and develop questions for class discussion. Topics will be assigned within the first couple weeks of classes.

*Lab notebook* - A laboratory notebook contains the permanent written record of a researcher's mental and physical activities from experiment and observation, to the understanding of new phenomena. There are also legal reasons for keeping a good notebook as this is admissible in a court of law for patent claims, for example. In this course, your final laboratory notebook will be part of your grade. The main criteria for evaluation will be, "Does the notebook clearly tell what was done?" And, if the notebook was sent to another laboratory, "Could they understand what was done and repeat the experiment?"

**Course Policies:**
Attendance: Except for extreme emergencies, which require official documentation, class attendance is compulsory. Each missed class will result in a 5% decrease to the student’s final grade. If an absence is anticipated or in the case of an extreme event, then contact the instructors as soon as possible to discuss the problem.

Late assignments will be downgraded by 5% for each day past the due date.

Missed Exam Policy: There are no make-up exams, except for extreme emergencies, which require official documentation. In such an event, contact us as soon as possible to discuss the problem. Class Presentations are considered examinations. An un-excused absence will result in lost points for that exam.

Policies regarding final examinations can be found at the following:
[http://www.uwm.edu/Dept/SecU/acad%2Badmin_policies/S22.htm](http://www.uwm.edu/Dept/SecU/acad%2Badmin_policies/S22.htm).
**Suggested Learning Objective Resources:** Learning in this course will rely heavily on reading of scientific literature - research papers, reference texts, and manuals. There is no assigned textbook. Required reading material for individual topics will be posted on D2L.

**General Course/Campus Policies:**
Students with Special Needs: Students with special needs should arrange to speak with the instructor(s) during the first week of classes so we can best accommodate your learning style.

Note University Policies: Students with disabilities. Verification of disability, class standards, The policy on the use of alternate materials and test accommodations can be found at the following: 

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Religious observances. Policies regarding accommodations for absences due to religious Observance are found at the following: 
[http://www.uwm.edu/Dept/SecU/acad%2Badmin_policies/S1.5.htm](http://www.uwm.edu/Dept/SecU/acad%2Badmin_policies/S1.5.htm)

Students called to active military duty. Accommodations for absences due to call-up of Reserves to active military duty should be noted.
[http://www3.uwm.edu/des/web/registration/militarycallup.cfm](http://www3.uwm.edu/des/web/registration/militarycallup.cfm)

Incompletes. The conditions for awarding an incomplete to graduate and undergraduate Students can be found at the following: 

Discriminatory conduct (such as sexual harassment). Definitions of discrimination. Harassment, Abuse of power, and the reporting requirements of discriminatory conduct are found at the following: 
[http://www.uwm.edu/Dept/SecU/acad%2Badmin_policies/S47.pdf](http://www.uwm.edu/Dept/SecU/acad%2Badmin_policies/S47.pdf)

Academic misconduct. In this course, you are expected to perform to the best of your ability In an honest manner. Cheating, plagiarism, or other acts of misconduct will result in a severe Penalty to you, as per University of Wisconsin System Chapter 1. 
[http://www.uwm.edu/Dept/OSL/DOS/conduct.html](http://www.uwm.edu/Dept/OSL/DOS/conduct.html) Plagiarism is a particular concern: many students seem unclear about what it involves. I recommend that you read:
[http://www.plagiarism.org/learning_center/what_is_plagiarism.html](http://www.plagiarism.org/learning_center/what_is_plagiarism.html) because ignorance is not acceptable as an excuse.

Complaint procedures. Students may direct complaints to the head of the academic unit or Department in which the complaint occurs. If the complaint allegedly violates a specific university policy, it may be directed to the head of the department or academic unit in which the complaint occurred or to the appropriate university office responsible for enforcing the policy.

Grade appeal procedures. Procedures for student grade appeal appear at the following: 
[http://www.uwm.edu/Dept/SecU/acad%2Badmin_policies/S28.htm](http://www.uwm.edu/Dept/SecU/acad%2Badmin_policies/S28.htm)

Final examination policy. Policies regarding final examinations can be found at the following: