2022

Spring 2022 Saturday Seminars Agenda

Shubha Tewari

Science & Engineering Saturday Seminars Spring 2022

Overview: These four-hour workshops are designed for teachers and educators interested in learning more about current topics in STEM research and education.

Workshops take place 9:00 am – 1:00 pm at UMass Amherst. Coffee and pastries provided at 8:30 am. (This may be revised depending on University restrictions at the start of Spring 2022).

We have five sessions planned in **Spring 2022**: on ~~**Jan 29**~~**, Feb 12, Mar 5, Apr 2, 9, 30**.

Early bird cost for the remaining workshops (up to December 15): $35 per session, $140 for all five. After December 15, $40 per session, $160 for all 5. 4 PDPs available per half day session.

You may also sign up for 3 graduate credits at reduced cost with the added return date of **April 30, 2022**. If you choose this route, there is a charge (TBD) for 3 graduate credits plus a $50 registration fee; register for **Nat Sci 697A**. This is in addition to the STEM Education Institute fee mentioned above.

Teachers may obtain credit for the seminar as many terms as they wish, but only 3 credits may be applied to UMass Amherst degrees. Registration for graduate credit is done online. For details on how to enroll, please see https://www.umass.edu/uww/class-enrollment

Those enrolled for graduate credit will be expected to develop and present a lesson plan in consultation with the STEM-Ed teacher-in-residence, Jennifer Welborn, and do a book report.

To sign up, fill the following Google form: https://forms.gle/T3egjkRLNQuTnC877

For further information, please contact Shubha Tewari, tewari@umass.edu

Workshop dates and Descriptions:

~~**Jan 29**~~

Feb 12, 2022 Superhydrophobic Surfaces: from Daily Life to State-of-the-art Research Findings

T. Leo Liu, Mechanical and Industrial Engineering & IALS, UMass Amherst

Many natural surfaces, such as lotus leaves and a water strider's leg, have shown striking water repellency so that they remain clean and dry even in "dirty" habitats. Such water repellency is called superhydrophobicity, which has stimulated lots of science and engineering imagination for self-cleaning windows, never dirty clothes, drag-reduction swimming suits, etc. In this workshop, we will use superhydrophobicity as a model to guide an integrative teaching and learning experience through hands-on experiments, critical thinking, basic science, as well as a lecture on state-of-the-art research discoveries. The objectives of this workshop are to (1) stimulate student curiosity and imagination through simple hands-on experiments to reproduce a superhydrophobic surface with simple resources like candles or sandpapers with dishes or glass slides, (2) link diverse daily life phenomena to superhydrophobic science and demonstrate how high-school physics plus critical thinking can be used together to advance fundamental science even today, (3) establish lesson plans for STEM education with a wide range of activities that can be adopted by different education levels (K-12), in different classes, and on different subjects. This superhydrophobic surface model can be easily extended to various bioinspired designs to further the interdisciplinary education on biology, chemistry, mechanics, etc. In general, this workshop will foster a life-learning habit that encourages students to keep their eyes open on daily observations and correlate them to the fundamental concepts they learn in the classroom.

Format: Workshop with multiple sessions of PowerPoint presentation, small-group discussion, and hands-on experiments

March 5, 2022. Plant, Pipettes and PCR

Elliott Kelly, Amherst Regional Middle School with Prof. Elizabeth Vierling, Biochemistry and Molecular Biology, UMass Amherst

Plants are amazing organisms that provide us with food, building materials, the pleasure of gardens, as well as providing the foundation of critical world ecosystems. Although they may look like they are just stuck in one place and doing not more than growing, they have many, many complex ways in which they respond to the environment. The goal of this STEM Ed session will be to discuss ways that plants can respond to the environment with hands on exercises and exploration of possible classroom activities. Participants will engage in state-of-the art methods of testing plant DNA composition using the polymerase chain reaction (PCR), as well as learn and "scheme" how these and other experiments on plant responses to the environment that have been integrated into both middle school and high school curricula can work for you. Please see https://sites.biochem.umass.edu/vierlinglab/ for some of the resources that can be discussed in this workshop.

April 2, 2022. Materials for clean energy

Ashwin Ramasubramaniam, Mechanical & Industrial Engineering, UMass Amherst
Omar Abdelrahman, Chemical Engineering, UMass Amherst

The need to transition to new and cleaner forms of energy has never been more imperative in the face of climate change. At the same time, the twin pressures from increasing global demand for energy and the scarcity of critical materials needed for new energy technologies impose additional challenges in making the transition to clean energy sources. In this workshop, we will explore how theory, modeling, and experiment are rising to the challenge of designing inexpensive, earth-abundant materials to enable the next generation of clean energy technologies. The goals of this workshop are: 1) to integrate concepts from chemistry, physics and engineering for materials design, and 2) explore through hands-on activities how alternative clean energy sources can be utilized in day-to-day applications.

April 9, 2022. Birds in an ecological web

Prof. Jeff Podos, Biology/ Organismic and Evolutionary Biology, UMass Amherst

One great way to learn about nature and biology is to study birds. There are many species of birds, both resident and migratory, and they all have their own habits, colors, songs, and ways of life. The popularity of birdwatching has skyrocketed in the US, especially during the pandemic. This seminar will describe one way to look at birds, and to learn about their ecology, evolution, and diversity. We start by focusing on birds' feeding habits and food preferences. Many birds have to eat and forage constantly, in order to stay alive and to feed their offspring. From this starting point we can then trace and understand all sorts of additional aspects of birds, including (but not limited to) their beaks, their colors, their songs, and their mating systems. We will talk about bird species both local and from South America, particularly from Brazil and from the Galapagos Islands.

April 30, 2022. From LCD to living liquid crystals

Prof. Shuang Zhou, Physics, UMass Amherst

Liquid crystals are a family of materials that can flow like a liquid, while having orientation order, like a crystal. Traditional liquid crystals are formed by small rod- or disk-shaped organic molecules that spontaneously align with each other. The orientation direction of the liquid crystals molecules, or the director, is sensitive to external fields. For example, a few volt of electric field can cause the director rotate 90 degrees and completely change the optical property of the sample. The susceptibility to external fields made liquid crystals an ideal material for optical switching applications, the best example

of which is the liquid crystal display (LCD). In this workshop, we will first explain some basic concepts of polarizing optics and test some daily birefringent materials. We will then look into how liquid crystals work as a central component in LCD. We will further characterize the opto-electronic performance of a one-pixel LCD using simple electronics and image analysis software ImageJ. At the end, I will introduce a new direction of liquid crystal research on water-based liquid crystals. By mixing microorganisms into them, we demonstrate a collection of new out-of-equilibrium phenomena that were not seen before in traditional liquid crystals. With this new “living liquid crystals”, we show application potential of “domesticating” microorganisms such as bacteria and parasites, and many more.

May 7, 2022: Recall date for those registered for graduate credit.