Syllabus & Policies

Course: Bio-inspired Surfaces, MECH 574/BIOM 574

Meeting times: Tue and Thu 8:00-9:15 am (Scott 229)

Instructor: Prof. Arun Kota
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Office: Scott 308
Phone: 970-492-4825

Instructor Office Hours: Tue and Thu 9:15-10:30 am

Textbook: There is no specific textbook. The lecture slides will be posted on Canvas and you will be pointed to the relevant book chapters and journal papers as and when appropriate.

Course Website: Syllabus, lecture slides, homework & exam solutions, grades will be posted on Canvas.

Course Description

This course will present and analyze the surfaces of a wide range of biological species, including lotus leaves, rose petals, water striders, arctic spring tails, sharks, desert beetles, and pitcher plant leaves. We will understand the unique surface functionality associated with each of these biological species by examining the roles of surface composition and surface texture. Subsequently, we will discuss how this fundamental understanding can be used to design bio-inspired surfaces for various applications such as spill resistant fabrics, microrobots, stain resistant displays, drag reduction, fog harvesting and de-icing.

Course Objectives

Upon successful completion of this course, each student will be able to:

- **Identify and describe** the unique surface functionalities associated with a wide range of biological species.
- **Explain** the fundamental concepts of surface and interfacial energies, contact angle, reentrant texture, hierarchical structure, superhydrophobicity, superoleophobicity, icephobicity, nucleation and slip length.
- **Use** equations for Cassie-Baxter state (single scale and hierarchical structures), Wenzel state, Vollmer's nucleation theory and Stokes' drag in order to analyze surfaces.
- **Determine** the appropriate surface composition (materials) and surface texture to obtain the desired surface functionality.
- **Apply** the principles learnt in this course to design bio-inspired surfaces for various applications such as spill resistant fabrics, microrobots, stain resistant displays, drag reduction, fog harvesting and de-icing.

Homework (20% of the total grade)

There will be ***two*** homework assignments in this course***. Late assignments will not be collected*** (Late = 0).

Exams (40% of the total grade)

There will be ***two*** take home exams, approximately in the 5th and 10th weeks of the course. There is ***no exam in the finals week***.

Tips to maximize your grade in homework (and exams)

Clearly list out the assumptions and known quantities in your solution. Use sentences (text) as much as possible to describe what you are doing. Note that it is the duty of the student to keep all returned papers and to produce said paper should any question arise as to the correctness of the given grade. ***Students have one week after graded homework (or a graded exam) is returned to question the given grade.***

Project Presentation (40% of the total grade)

There will be ***one*** presentation per student (or group) towards the end of the semester. There will be 30 minutes allocated for the talk and another 30 minutes allocated for question & answer session. The order of presentations (who goes 1st, 2nd etc.) will be decided by the instructor.

The presentation will be based on a paper (or topic) related to the concepts covered in this course. The paper (or topic) will be chosen by the student (or group) and ***must have the instructor's approval***. The paper (or topic) of the presentation must be finalized by the end of Spring break.

Each presentation will be graded by the instructor, as well as, other students in the class. ***Attendance for all presentations is mandatory for all students – there will be penalty for absence!***

Attendance and other policies

Attendance for all lectures, exams and presentations *on time* is mandatory. It is the student's responsibility to read the assigned papers, as well as, listen to the lectures to understand the content. Sleeping and using cell phones in class is forbidden. ***If you have an emergency and cannot attend a lecture, exam or presentation, please alert the instructor prior to class or as soon as possible***.

Grading

Homework – 20%
Exams – 40%
Presentation – 40%

CSU Online (i.e., distance education or non-resident) students

CSU Online students should turn in homework and exams via email to arun.kota@colostate.edu. CSU online students must work closely with CSU Online classroom support (e.g., get familiar with using Adobe Connect plugin, turn in their project presentations 2 business days before their presentation day, have the necessary hardware like computer, webcam, mic etc) to ensure that the project presentations proceed smoothly. All other policies for CSU Online students will be the same as those for resident students. The recorded lecture can be accessed via Canvas.

Academic Integrity Policy

All students taking this course are required to adhere to:

- The Policies and Guiding Principles (http://facultycouncil.colostate.edu/files/manual/sectioni.htm#I.5.1) governing student conduct at CSU, and
- The Mechanical Engineering Student Academic Integrity Policy (http://www.engr.colostate.edu/me/pages/undergraduate/programs-requirements/AcademicIntegrity.pdf).

Please review both links.