

## **Engineering Tripos Part IIA Project, GC3: Mechanics of Natural Materials, 2019-20**

### **Leader**

[Dr J H Durrell](#) [1]

### **Timing and Structure**

Lent Term preparation meeting: 28th February, 1-2pm JDB Seminar Room. Easter Term Timing: Thursdays 9-11am plus afternoons; and Mondays 11-1pm.

### **Prerequisites**

No prerequisites required, however Paper 3-Materials and 3G5 Biomaterials provide foundation.

### **Aims**

The aims of the course are to:

- Understand how microstructure contributes to the mechanical properties of natural materials;
- Consider the most appropriate measurement techniques based on the material property of interest;
- Appreciate the design principles of biological tissues in nature from a mechanics prospective.

### **Content**

Natural materials have evolved structures that are fit for their functions. Plant tissues, for example, illustrate nature's remarkable engineering ingenuity, ranging from resilience in external forces from the environment, to providing dynamic regulation in water intake. This laboratory exercise investigates the mechanical behaviour of a variety of natural materials, and how it is influenced by their microstructure on a range of scales. Extending from the IB Materials course, microscopy and mechanical testing techniques will be utilised to study tissue mechanics at different length scales, from hard and strong wood specimens, to micro fibrous materials.

Please note that due to sabbatical this project will operate at reduced capacity (12) and will concentrate on wood and paper, and the sub project on stress-strain curve of living cells will not run.

Students will work in groups of 6, with detailed investigations within each group carried out by three separate pairs. Each group of 6 will examine a different natural material system. After an initial training exercise each group will propose a specific investigation and plan how the detailed tasks will be allocated between the 3 pairs. Students will submit individual reports, but will also participate in a final group presentation pulling together what has been learned by the whole group.

The natural systems on offer will include wood and paper. The assignment to particular systems will take place at consultation and briefing meeting in the Lent term.

### **Week 1**

Training exercise, to introduce relevant testing methods for the particular natural materials to be studied. Write first interim report, and produce group-based proposal for the main study.

## Weeks 2-4

Carry out detailed studies on the chosen theme. Write final report, and prepare final group presentation.

## Coursework

Coursework	Due Date	Marks
Interim report and project plan	11th May 2020	15 (5 individual, 10 pair/group)
Group presentation (JDB Seminar Room 9-11)	4th June 2020 (AM)	20 (group)
Final report	4th June 2020 (PM)	45 (35 individual, 10 pair/group)

## Examination Guidelines

Please refer to [Form & conduct of the examinations](#) [2].

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### Links

[1] <mailto:jhd25@cam.ac.uk>

[2] <https://teaching.eng.cam.ac.uk/content/form-conduct-examinations>