

NEWFRAC CORE SCHOOL

Brief summary of Lectures

Bones & Arteries

Prof. Zohar Yosibash

50 min - Lecture

Mechanical properties of bones and arteries. General topics, how these organs are constructed and the constitutive models to address them from solid mechanics viewpoint. How “simple” bones are compared to “arteries”.

Composite Materials I

Prof. Federico París

65 min – Lecture

Foundations of Composite Materials: Definitions and main features of Composites. Morphology of Composites, Components and properties (Fibre, Matrix and Interphase), Some examples showing properties of Composites under impact, Basic Concepts of fabrication of composites, Basic concepts of behaviour of composites, Applications of Composites in the aeronautical Industry.

Composite Materials II

Prof. Albertino Arteiro

65 min – Lecture

Failure mechanisms: Micromechanics of failure. Non-phenomenological failure criteria: Maximum stress failure criterion, Maximum strain failure criterion, Tsai-Hill (deviatoric strain energy) failure criterion, Tsai-Wu (interactive tensor polynomial) failure criterion. Phenomenological (mechanism-based) failure criteria: Hashin failure criteria, Puck failure criteria, LaRC failure criteria (2D and 3D), 3D invariant-based failure criteria. Universal laminate failure criteria: omni failure envelopes.

Ceramics

Prof. Raúl Bermejo

60 min – Lecture

Fundamentals of Ceramics. Atomic bonding in ceramics and typical crystal structures. Types of defects in ceramics. Diffusion. Sintering process in ceramics. Consolidation of microstructures. Mechanical properties: Interpretation of Weibull statistics to assess strength distributions in ceramics. Effect of microstructure, surface conditioning and environment on the strength distribution, and consequences for the design.

Responsible Research & Innovation I & II

Rosina Malagrida, MSc

240 min – Lecture

The EC and many other funding organizations, but also different research groups and research performing organizations around the world are starting to implement changes in the way R&I is being performed. Under frameworks such as “Responsible Research and Innovation”, they are facilitating open and inclusive initiatives where different stakeholders (researchers from different disciplines, industry, civil society organizations, policy makers and the education community) collaborate with each other to make sure that both processes and outcomes of R&I are better aligned with their needs and expectations. At the same time, this change of paradigm is also meant to contribute to decrease waste research, identify unmet needs, facilitate transdisciplinarity and make R&I more democratic and legitimate, therefore contributing to improve the relationship between science and society.

Basics of Scientific Working and Writing I

Dr. José Reinoso

90 min – Lecture

In this first lesson, a first introduction to the scientific method and the scientific work is provided. The second part of the lesson covers basic guidelines concerning the scientific writing, and presentation of the results. Particular details are given concerning the production of scientific papers in peer reviewed journals, conferences proceedings, among others.

Fracture Mechanics I

Prof. Federico Paris

120 min – Lecture

Introduction to Fracture Mechanics. Linear Elastic Fracture Mechanics based on Theory of Elasticity: Modes of Fracture, Asymptotic solution, Stress Intensity Factor (SIF) concept, Growth criterion based on SIF: Fracture toughness concept. Linear Elastic Fracture Mechanics based on Energy balance: Energy Balance, Griffith criterion (Growth under constant displacement, Growth under constant force), Equivalence between Elasticity and Energy Approaches, Stability of the growth of the crack, Fracture Resistance. R-curve concept.

Experimental Techniques I

Prof. Pedro P Camanho

105 min – Lecture

Interlaminar Fracture Mechanics tests: DCB, ENF & TCT test and MMB. Intralaminar Fracture Mechanics tests: Contact tension/compression and Double-edge notched tension/compression – extension to high strain rates.

Experimental Techniques II

Prof. Zohar Yosibash

30 min - Lecture

Measurement methods using DIC and SGs for hard tissues and in the vicinity of V-notches. The importance to design the proper experiments and make sure that the data of interest can indeed be measured.

Bibliographic Studies and Databases I

Dr. José Reinoso

90 min – Lecture

This lesson covers the basic principles of literature review for the generation of a proper State of the Art in the research activity. Data and publication search in indexed journals, and the different databases and search tools currently available. This lesson covers the introduction to Scopus, Web of Science, Mendeley, among many other different tools.

Fracture Mechanics II

Dr. Dominique Leguillon

120 min – Lecture

Singularities in homogeneous and heterogeneous materials, generalized stress intensity factors. How to compute these elements in complex situations. Application to the coupled criterion as a generalization of Griffith's criterion. Crack initiation at V-notches and some examples of interaction between cracks and interfaces.

Experimental Techniques III

Prof. Federico París

105 min – Lecture

Failure criterion of composites. Comparison with failure criteria of Metals. The test Pyramid for testing composite structures. Examples of testing components and full structures of composites. A case of research for the immediate future: Use of Ultra-thin plies for Composites.

Effective Communication & Feedback Management

David Pérez, CEO Cubicoff

180 min – Lecture

Communication into business organizations: General concepts of communication and Improvements in communication. How leaders lead and motivate teams: Profiles, Styles and Responsibilities of leadership and Concepts, Roles and Motivation into teams.

Numerical Techniques in Fracture I

Prof. Laura de Lorenzis

120 min – Lecture

Introduction to numerical techniques for linear-elastic fracture mechanics, methods for computation of the stress intensity factor, methods for computation of the energy release rate, the G-theta method. Brief overview of numerical techniques for fracture propagation.

Numerical Techniques in Fracture II

Prof. Corrado Maurini

120 min – Lecture

Basic techniques in (otherwise linear) finite elements to compute the energy release rate and drive some simple crack propagation problems, e.g. the Virtual Crack Closure technique and the stress intensity factors in linear elastic analyses from displacement or stress fields computed with the FEM. Explicit example of the computation of the ERR in FEniCS and eventually crack propagation along a straight line.

Idea Management

Prof. Marco Paggi

210 min – Lecture

The key steps to manage research ideas; how to exploit research ideas (patents, third party-contracts, spin-offs, knowledge and/or technology transfer); and how to present organize and present ideas. Examples on how to present ideas in a concise and effective manner (elevator pitch format) are provided.

Organizing & Presenting

Prof. Marco Paggi

60 min – Lecture

Presentation of elevator pitches from the participants, on research projects of their interest. Suggestions on how to improve the organization and the presentation of their ideas.

Gender Issues in Research & Innovation

Sonia Saborit

120 min – Lecture

The training session will include the following sections: General concepts and definitions. Gender Equality on Research and Innovation: issues at stake. Integration of the gender dimension in research and innovation contents.

Bibliographic Databases II and Research Ethics

Prof. José Reinoso

90 min – Lecture

This lesson continues the previous session on the matter with a more practical perspective. We address several examples and guidance of the use of databases Scopus, Web of Science and literature collection, Mendeley. The second part of the lesson covers details of research ethics and good practices.