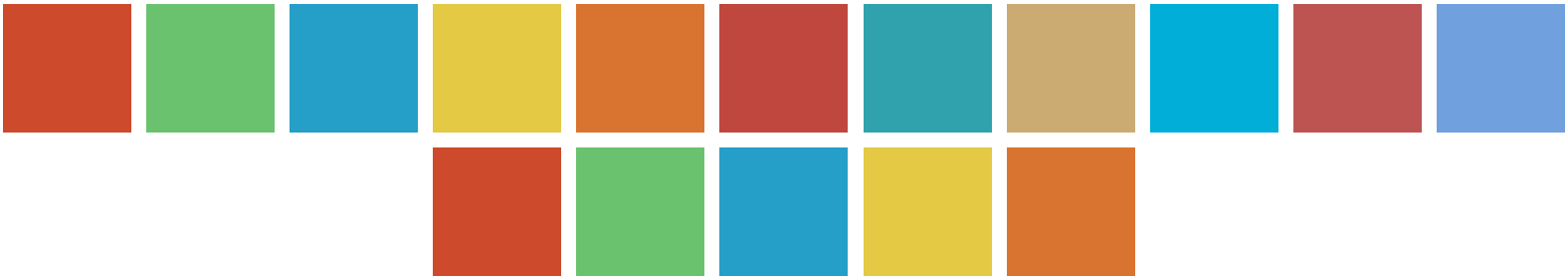
UNIVERSITÀ
DEGLI STUDI
DI TORINO

100762

COURSES BROCHURE



Dottorato in Scienze Chimiche e dei Materiali

Bioinspired materials

Bioinspired materials

Academic year:	2019/2020
Course ID:	
Teacher:	Federico Bosia (Titolare del corso)
Teacher contacts:	0116707889, federico.bosia@unito.it
Year:	
Type:	Facoltativo
Credits/recognition:	2
Course SSD (disciplinary sector):	FIS/03 - fisica della materia
Delivery:	Tradizionale
Language:	Inglese
Attendance:	Obbligatoria
Type of examination:	Quiz

COURSE OBJECTIVES

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- Provide an overview of the main structural features of biological materials and the main differences with the most common artificial materials in technological fields

- Provide an introduction to the theories of elasticity, fracture mechanics, and propagation of elastic waves

- Provide an overview of composite and nanocomposite materials for structural applications

- Provide an overviwe of the principles of bio-inspiration, provide examples of interest, and discuss the main current research topics in the field of mechanics

- Provide examples of bioinspired approaches in various fields of materials science including: lightweight, strong and tough materials, adhesive materials, materials for friction control, materials and structures for vibration control

- Provide an overview of research on metamaterials, with examples of applications and links to the field of bio-inspired materials

it

- Fornire una panoramica sulle principali caratteristiche strutturali dei materiali biologici e le principali differenze con i materiali artificiali più diffusi in ambito tecnologico

- Fornire elementi di base di elasticità, resistenza dei materiali, e propagazione di onde elastiche

- Fornire una panoramica sui materiali compositi e nanocompositi per applicazioni strutturali

- Fornire un quadro dei principi della bioispirazione, fornire degli esempi significativi, e discutere le principali linee di ricerca attuali in ambito meccanico

- Fornire degli esempi di approcci bioispirati in vari campi della scienza dei materiali, tra cui: materiali leggeri, resistenti e tenaci, materiali adesivi, materiali per il controllo dell'attrito, materiali e strutture per il controllo delle vibrazioni

- Fornire una panoramica della ricerca sui metamateriali, con esempi di applicazioni, collegando il discorso al campo dei materiali bioispirati

PROGRAM

The course covers some of the main topics in the mechanics of biological and bioinspired materials, i.e. materials that draw inspiration from specific examples found in Nature that display exceptional performances and functionality.

Topics:
Biomaterials and biological structural materials: wood, bone, tendons, spider silk... ;
Achieving function through structure: examples of bioinspired design (e.g. gecko paws, spider webs, lotus leaves);
Importance of hierarchical structure;
Simultaneous optimization of competing properties: Strength vs. toughness, Stiffness vs. density, etc. Biomimicry and bioinspiration.
Artificial materials: traditional composite materials, nanocomposites and their applications.
Hierarchical composite materials. Bioinspired composite materials. Self-healing materials.
Metamaterials.
Review of basic physical concepts and their application to biological/bioinspired materials: elasticity, fracture mechanics, flaw tolerance, fatigue, adhesion/antiadhesion, hydrophobicity, friction, wave propagation and damping.
Theoretical models and numerical approaches used in the modelling of heterogeneous (composite) materials; multiscale modelling; fibrous materials and fibre bundle models; finite element modelling; peridynamics.
Examples and case studies.

Course webpage: https://dott-scm.campusnet.unito.it/do/corsi.pl/Show?_id=7zgu

Solid state NMR: basics and applications

Solid state NMR: basics and applications

Academic year:	2019/2020
Course ID:	
Teacher:	Prof. Roberto Gobetto Prof. Michele R. Chierotti
Teacher contacts:	+39 011-6707520, roberto.gobetto@unito.it
Year:	
Type:	Obbligatorio
Credits/recognition:	3
Course SSD (disciplinary sector):	CHIM/03 - chimica generale e inorganica
Delivery:	Tradizionale
Language:	Inglese
Attendance:	Obbligatoria
Type of examination:	Quiz

PROGRAM

Introduction to Solid-State NMR

- NMR interaction tensors
- Dipolar interaction
- Chemical shielding
- Relaxation times

From low to high resolution spectra

- HPPD and MAS
- Cross polarization

High resolution solid state NMR of 1H and 19F

Applications of Solid State NMR:

- Organic Molecules
- Polymorphic forms
- Biological molecules
- Polymers
- Materials: Zeolites and Inorganic Compounds

Course webpage: https://dott-scm.campusnet.unito.it/do/corsi.pl/Show?_id=x3al

The vitreous state

The vitreous state

Academic year:	2019/2020
Course ID:	
Teacher:	Prof. Livio Battezzati
Teacher contacts:	011-670 7567, livio.battezzati@unito.it
Year:	1st year 2nd year 3rd year
Type:	Facoltativo
Credits/recognition:	3
Course SSD (disciplinary sector):	ING-IND/22 - scienza e tecnologia dei materiali
Delivery:	Tradizionale
Language:	Inglese
Attendance:	Obbligatoria
Type of examination:	Quiz

PROGRAM

This short course is intended to provide an overview on some scientific and technological issues concerning glasses.
Topics:
Definition of non-crystalline solids and glasses.
The structure of glasses: short and medium range order.
Glass-forming liquids and the glass transition: thermodynamic and transport properties.
Conditions for vitrification: nucleation and growth of crystals. Synthesis of glasses.
Structural relaxation in glasses.
Selected properties of glassy materials: mechanical, thermal, optical, electronic properties.

Course webpage: https://dott-scm.campusnet.unito.it/do/corsi.pl/Show?_id=geej

UV-Visible Light Photocatalysis: Concepts and Application In Organic Synthesis

UV-Visible Light Photocatalysis: Concepts and Application In Organic Synthesis

Academic year:	2019/2020
Course ID:	
Teacher:	Prof. Valter Maurino (Titolare del corso) Prof. Annamaria Deagostino (Titolare del corso)
Teacher contacts:	39-011-6705218, valter.maurino@unito.it
Year:	
Type:	Facoltativo
Credits/recognition:	3
Course SSD (disciplinary sector):	CHIM/01 - chimica analitica CHIM/06 - chimica organica
Delivery:	Tradizionale
Language:	Inglese
Attendance:	Obbligatoria
Type of examination:	Quiz

COURSE OBJECTIVES

This course is intended to provide an overview on molecular and heterogeneous photocatalysis and its application for energy harvesting and chemical synthesis

Didactical objectives are:

Provide the theoretical background of photochemistry and photophysics of homogeneous and heterogeneous photocatalysis
To give an overview of the current and potential applications of photocalysis in organic chemistry, emphasizing new routes not achievable by thermal reactions

PROGRAM

Photochemistry: Absorption and luminescence; Intensity of Electronic Transitions; Excited States Radiative Lifetimes; Energy and Electron Transfer; proton transfer and H atom abstraction; Photosensitization, Rates and Quantum Yields; Quenching of Excited States; Identification, Classification and Reactivity of Excited States (organic molecules; inorganic and organometallic complexes)
Molecular (homogeneous) photocatalysis, semiconductor photocatalysis and photoelectrochemistry, water photosplitting
Main photocatalyzed organic reactions
Visible light photocatalysis promoted by photocatalyst activation
Cooperative/dual photocatalysis

Few examples of visible light induced transition metal-catalyzed transformation

NOTE

The course will be delivered in September 2019

Course webpage: https://dott-scm.campusnet.unito.it/do/corsi.pl/Show?_id=fggx