UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

# COURSE SYLLABUS

# Synthesis and Special Organic Techniques in Materials Chemistry

**2122-2-F5302Q008**

## Aims

The course provides an overview on preparation and typology of functional materials exploitable in photonics and organic-based semiconductors and on photophysic and photochemical aspects involved in organic reactions stimulated by electromagnetic radiation. Basic concepts also provides on organic photochemistry used in organic synthesis.

O1 – knowledge and understanding

To follow the course, the student have to possess an adequate comprehension and skills of organic chemistry:

1) To recognize an unsaturated organic system with non-linear optical properties.

2) To individuate the structural molecular parameters important for non-linear behavior (ii and III order).

3) To be able to perform a reasonable retrosynthetic analysis to individuate efficient synthetic strategies.

4) To show adequate skills on organic functional groups and the use of them in the preparation of conjugated unsaturated systems; skills on metal catalyzed cross-coupling protocols.

5) To prepare the principal polymeric materials currently use as conducting, semiconducting and electroluminescent devices.

6) To describe the principal photophysical and photochemical processes involved in the absorption of electromagnetic radiation (UV/Vis light)

O2 – Applying knowledge and understanding

The student, during the assessment method has to demonstrate an adequate capability of applying the knowledge and understanding of the provided concepts:

1) To recognize the structural and electronic parameters at the base of non-linear properties in general and specifically in organic push-pull systems.

2) To apply the retrosynthetic approach to the simplification of the synthesis strategies of organic systems with non-linear properties, individuating the useful disconnections, the synthons so far generated and the corresponding synthetic equivalents.

3) To manage the reactivity of the principal organic functional groups.

4) To manage the principal coupling strategies of unsaturated moieties.

O3 – Making judgements

To be able to conduct a reasonable retrosyntetic analysis to organic systems with potential application in the materials sciences field.

O4 –Communication skills

To be able to show and identify organic systems of interest in the materials science field their retrosynthetic and synthetic approaches, using an appropriated language.

O5 –Learning skills

To be able to apply the acquired knowledge and expertise to retrosynthesis and to preparation of of organic systems with different optical and electronic properties.

## Contents

The course provides an overview on the preparation of organic materials with specific optical and electronic properties exploitable in the field of photonics, organic semiconductors and on the synthesis of principal polymers with application as organic conductors or electroluminescent devices. An overview provides on organic photochemistry supporting the organic synthesis promoted by light.

## Detailed program

Synthesis of molecular structures with non-linear optical properties second and third order and functional materials. In details is analysed: the synthesis of “Push-Pull” molecular structures with oligoenes, oligoynes, oligoaryls, oligoheteroaryls and mixed aryl or heteroaryl-enes (or ynes) P-spacer connecting organic or organometallic electrondonating and electronwithdrawing groups. Synthesis of molecular oligomeric and polymeric structures showing III order non-linear optical or conductive and/or electroluminescent properties materials with particular

emphasis to polyarene, polyheteroarene and polyarenevynilidene conjugated unsaturated systems. Polymers for energy: thiophene-based polymers, Donors-Acceptors polymers. Basic concepts and application of organic photochemistry in organic synthesis.

## Prerequisites

For an optimum understanding of the topic treated, a consolidated organic chemistry background is required together with basic knowledge on the optical and electronic properties of polyconjugated organic molecules and polymers.

## Teaching form

Lectures in classroom

## Textbook and teaching resource

Notes provided by the lecturer

## Semester

II year, I semester

## Assessment method

Oral examination is the assessment method employed to check the level of understanding of the concepts taught during the course. Questions will ask to the student regarding the entire topic treated during the course. The final mark proposed to the student is in thirtieths, and a final minimum mark of 18/30 is necessary to pass the examination. On the student request, the assessment can be hold in English.

## Office hours

Prof. Papagni receives students Friday from 14.30 to 16.30. Students must fix an appointment in advance