

# IPL International Summer School: Science and Engineering

## June 13 – July 11, 2024

### Lyon, France

## The €2150 program fee covers:

### Housing in a student residence

Individual rooms with bathroom.

### French classes

ECTS credits: 2. Three levels: beginner, intermediate, advanced.

### Tentative list of cultural and industrial visits and activities

Transportation provided.

#### In Lyon

A tour of the city  
A cooking class  
A French session at the local market  
A session on intercultural communication  
A recycling center where plastic waste is reused and turned into a valuable product

#### In Geneva

A tour of the CERN (European Organization for Nuclear Research)  
Free time to visit the city center of Geneva

#### Tain l'Hermitage

Valrhôna: chocolate museum and factory with a tasting

Cave de Tain: tour of a winery with a tasting

#### Romans-sur-Isère

Tanneries Roux: leather production site

Lunch provided: traditional *ravioles du Dauphiné*

Musée de la Chaussure: shoe museum, presents history of leather goods in the region

### Practical lab sessions at ITECH

ECTS credits: 7

#### **I. Adhesive formulation and practical work in application**

Instructor: Sylvie Durdilly

##### **Manufacturing, application, and controls of a wood adhesive with:**

- Formulation of the adhesive
- Specifications
- The role of raw materials
- Control of bonds (on the wood shear ample)
- Shear test with a dynamometer
- Application of a pressure sensitive adhesive
- Loop tack test with a dynamometer

#### **II. Manufacturing of decorative water-based paints**

Instructor: Jean-Pascal Philibert

##### **Main steps of the process**

- Handling the raw materials for a white water-based paint (fillers, pigment, binder, additives )
- Carrying out all the stages of the process
- Application on standard panels
- Quality control of decorative paint: rheology/opacity/gloss/specific gravity/dry content
- Analysis of the results

## Learning outcomes

- Process engineering: water-based coating manufacturing
- Structure/properties relations: impact of raw materials on coating performances
- Quality control: how to characterize a liquid paint formulation

## III. How to design a plastic part: from design to manufacturing

Instructor: Cédric Boschard

### How to choose a plastic material

- Practical work on materials recognition

### How to design a part

- Demonstration on DAO software

### The different manufacturing techniques

- Plus demonstrations in injection, thermoforming...

### Learning outcomes

- Characterization of plastic materials (tensile, break...)
- Injection molding and thermoforming

## IV. Practical work in colorimetry

Instructor: Caroline Goutteborge

### Course content

- Presentation of basics of colorimetry: observation conditions (lights)
- Color characteristics (hue, chroma, lightness)
- Presentation of colorimetry software:
  - o Quality control: interpretation of colorimetry data (Cielab color space)
  - o Formulation, correction: use a pigments file to match a color

### Practical work

- Reproduce a target color using colorimetric software and lights cabin

### Learning outcomes

- Visual evaluation of color
- Measurement of tonality, saturation, color
- Color matching (with various tools)

## V. Introduction to leather manufacturing

Instructors: Franck Diaz & Agnès Thomasset

### Theoretical content

- Introduction to leather production and products (1 h)
- The basics of leather formulation (1h)

### Practical work

- Production of finished leather by students (5h): garment, shoe upper, handbag leather on lambskin and cow hide.

### Learning outcomes

- Basics of protein reactivity
- Tannins and cross linking of collagen
- Hiding leather defects in leather
- Basic knowledge of leather production
- Dye and pigment selection

## VI. Analytical chemistry

Instructor: Pascale Fillon

### Practical work to learn chemistry laboratory skills, notably the following:

- Gas chromatography: gas chromatography principle and concrete application on the analysis of a mixture of unknown solvents (separation, identification and quantification)

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- Infrared spectro-photometry principle: sampling techniques according to the product under analysis, highlight of major chemical bonds, identification of unknown polymers, concrete applications on any type of support (liquid, powder, plastic material, paint, textile, leather...)

#### Learning outcomes

- What gas chromatography analysis and infrared spectro-photometry are used for, what information they allow one to gather about a product
- “Reverse engineering”: analyzing the components of materials
- Become familiar with some of the machines used to carry out these analyses, how to interpret the results

## VII. Introduction to cosmetic products

Instructor: Caroline Bouchez

#### Theoretical class:

- What is an emulsion
- What are lipsticks made of?

#### Practical class:

##### Make-up products: lipstick

- Formulation and characterization of a lipstick
  - with different waxes
  - with different oil phases
  - Controls: sensory tests

##### Skin care products: emulsions

- Formulation of oil/water and water/oil emulsions
  - with different nature of surfactants
  - with different oil phases
  - Controls: pH, viscosity, centrifugation and microscope observations

#### Learning outcomes:

- Basic principles of chemical formulation with the added sanitary constraints applied to cosmetics
- Characterization: analysis and measure of materials' structure and properties
- Introduction to controls: quality, tests for desired properties
- Introduction to some of the main raw materials used in cosmetics

## VIII. Introduction to textile manufacturing

Instructor: Fabien Roland

#### Presentation of the manufacturing textile chain, from raw materials to end-products

- Overview of textile technologies and relative machines
- Visit of the textile platform
  - Spinning, weaving and knitting workshops
  - Finishing and testing laboratories

#### Practical work: treatments on a cotton/polyester blend fabric

- Dyeing
  - Use of a dyeing lab machine, type jigger
  - Development of a dyeing recipe and a dyeing process
  - Analysis of the result: color yield, levelness
- Chemical finishing
  - Use of a finishing lab line, type padder and stenter frame
  - Development of a finishing recipe with fluorocarbon-based repellents
  - Analysis of the result: water and oil repellency control

#### Learning outcomes

- Textile manufacturing technologies
- Dyeing machinery and process
- Stain-repellent finishing

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## IX. Introduction to Polymers

Instructor: Mathilde Simon

### 1. History and use of polymers

First use and synthesis of polymer, use of polymers today

### 2. What is a polymer?

Definition of polymer, monomer, macromolecules, molar mass

### 3. Polymer family

Types of polymer: thermoplastic, thermoset, elastomer

Origin of polymer: natural, artificial and synthetic

### 4. Application of polymers

Different examples of the ITECH specialties: polymers applied to formulation, leather, plastic and textiles

**Applications open. Ideal for students with one or two years of undergraduate studies in science, especially chemistry.**

**For more program information and the application, visit:**

**[www.iplsummerschool.com](http://www.iplsummerschool.com)**

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