



**NATIONAL UNIVERSITY OF ENGINEERING**  
**COLLEGE OF CHEMICAL AND TEXTILE ENGINEERING**  
**TEXTILE ENGINEERING PROGRAM**

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**PIT49 – TEXTILE CHEMICAL PROCESSING II**

**I. GENERAL INFORMATION**

<b>CODE</b>	: PIT49 Textile Chemical Processing II
<b>SEMESTER</b>	: 9
<b>CREDITS</b>	: 3
<b>HOURS PER WEEK</b>	: 3 (Theory-Practice-Laboratory)
<b>PREREQUISITES</b>	: PIT39 Fabric Chemical Processing I PIT40 Laboratory of Fabric Chemical Processing I
<b>CONDITION</b>	: Compulsory
<b>DEPARTMENT</b>	: Textile Engineering

**II. COURSE DESCRIPTION**

The course prepares students in the analysis and synthesis of colorants for the dyeing of fibers and fabric in the textile industry. Students understand the methods for specifying and measuring color, as well as analyze dyeing materials for different types of fibers such as cellulosic, wool, polymer and other synthetic fibers. The chemical compounds and properties of colorants are analyzed, as well as the process of dyeing and the required equipment for a proper color fixing.

**III. COURSE OUTCOMES**

At the end of the course, students:

1. Analyze and synthesize colorants for textile dyeing.
2. Formulate, correct and evaluate a color in the colorimetric system.
3. Analyze color spectral components.
4. Relate the structure of dye compounds with light.
5. Identify the behavior of machinery for textile dyeing.
6. Interpret and discuss procedures for the different types of fiber dyeing.

**IV. LEARNING UNITS**

**1. COLOR AND COLORIMETRY - 9 Hours**

The color in the textile industry / Factors that influence the perception of color / Specifications of color, chromatic colors / Elementary colorimetry / CIE system / Coordinates of chromaticity / The "CIE" chromaticity diagram / Curve of color remission, color constancy, metamerism / Sensometric CIELAB and CIELCH color systems / Color contrast, subdivisions.

**2. PRACTICAL COLORIMETRY - 3 Hours**

Colorimetric system / Accuracy of calculated formulas / Preparation and analysis of model primary tinctures / Choice of substrates / Elaboration of dyer procedure / Combination of dyes. / The nuanced theory / General functions of dyer / Cleaners management.

**3. DYEING MATERIALS - 3 Hours**

Absorption of light / Color and the molecular structure of compounds / Resonance, conjugation and electronic transitions / Importance of chromophores and auxochromes in the generation of color / Bathochromic e hypochromic effects.

**4. DYES IN THE TEXTILE INDUSTRY - 3 Hours**

Nomenclature of dyes for the textile industry / Universal naming according to SDC / First criterion: number of constitution, chemical classification, chromophores of dyes / Second criterion: color index, classification utility of dyes / Classification of dyes by the method of application.

**5. DYEING OF CELLULOSIC FIBERS WITH DIRECT DYES - 3 Hours**

Tincture of the cellulose fibers (cotton) / Brief review of the molecular structure of cellulosic fibers / Theoretical foundations and mechanism of dyeing of cellulosic fibers / Dyeing of cellulosic fibers with direct dyes / Characteristics / Fixing mode / Practical classification according to SDC / Parameters to control dyeing with direct dyes / General procedure for dyeing with direct dyes: dissolution of the coloring, dyeing and subsequent treatments.

**6. DYEING OF CELLULOSIC FIBERS WITH REAGENT DYES - 6 Hours**

Properties / Basic structure of reactive dyes / Chemical constitution / Fixing mode / Types of reactive dye (classification) / Dye-fiber reactive systems / Application procedures: continuous and exhaustion dyeing methods / Problems in dyeing with reagent dyes: properties, profile SERF, measurement of the rate of migration, compatibility factor.

**7. DYEING OF CELLULOSIC FIBERS WITH SULFUR DYES - 2 Hours**

Dyeing of the cellulose fibers with sulfur dyes / Features / Fixing mode / Classic classification / Parameters to control in dyeing with sulfur dyes / Method of application: dissolution of coloring / Dyeing and oxidation / New generation of sulfur dyes: ecological dyes.

**8. DYEING OF CELLULOSIC FIBERS WITH TINA DYES - 2 Hours**

Characteristics / Chemical classification: the indigoids / Setting mode: REDOX, reduction and oxidation process of the bath dye / Stages of the beck: reduction of coloring, coloring uptake by the fiber, oxidation and soaping / Classification practice / Application procedures.

**9. DYEING CELLULOSIC FIBERS WITH SOLUBILIZED TINA DYES - 2 Hours**

Overview / Fixing mode / Classification / Methods of application to exhaustion: dyeing, development and finishing / Continuous method / Impregnation by foulard, development and further processing.

**10. DYEING OF POLYESTER FIBERS - 3 Hours**

Dyeing of polyester fibers / Theoretical foundation and mechanism of dyeing of polyester fibers / Chemical constitution of disperse dyes / Features / Fixing mode / Classification of disperse dyes / Parameters influencing dyeing / Current technology of dyeing: exhaustion in continuous processes / Thermosol procedure, general technology of the process.

**11. DYEING OF WOOL - 3 Hours**

Review of chemical structure and morphology of wool fiber / Process of dyeing / Acid dyes for dyeing of wool / Dyeing properties and chemical classification / Mechanism of tincture absorption / Procedures of tincture / Obtained fastness / The theory of Gilbert and Rideal / Langmuir isotherm.

**12. DYEING MACHINERY - 3 Hours**

Dye transfer systems: by exhaustion and impregnation / Machinery for exhaustion dyeing / Skeins of yarn dyeing machines / Machinery for dyeing by impregnation / Machines for knitting exhaustion dyeing: modern technology for this type of fabric dyeing.

**V. METHODOLOGY**

The course takes place in theory, practice and laboratory sessions. In theory sessions, faculty presents the concepts and methods. In practice sessions, students solve diverse problems related to dyeing of different types of textile fibers and fabric. In laboratory sessions, students carry out experimental tests to analyze dyeing performance and color fixing. At the end of each experiment, students present a report summarizing procedure, results, drawings and conclusions. Student active participation is promoted.

**VI. GRADING FORMULA**

The Final Grade PF is calculated as follow:

$$PF = (EP + 2*EF + PP) / 4$$

EP: Mid-term Exam

EF: Final Exam

PP: Practical Work

**VII. BIBLIOGRAPHY**

1. CLIFFORD PRESTON.  
The Dyeing of Cellulosic Fibers.
2. R. H. PETER.  
Textile Chemistry.
3. JOSE CEGARRA and JOSE VALLDEPERAS.  
Scientific Fundamentals Applied to the Dyeing of Textile Materials.