



COURSE ID SHEET

Course No.	5306	NTUA			
Semester:	8,10	Core	Elective	Specialization	X

TITLE **Polymers Processing**

AIM The scope of this course is the enlargement and enhancement of knowledge of the students in the field of processing techniques (modification and moulding) of polymers, aiming at the production of final products with the desired, pre-designed properties.

CONTENT

- **INTRODUCTION.** Polymers melt rheology: Analysis of simple flows. Polymers rheometry. Extrudate swell and Melt flow instabilities.
- **BLOW MOLDING:** Extrusion blowing. Injection blowing. Injection stretch blowing.
- **OTHER MOULDING TECHNIQUES.** Thermoforming process. Rotational moulding process. Casting process. Compression process.
- **POLYMERS MIXING:** Characterization of mixing mechanisms (Distributive mixing, Dispersive mixing, Laminar mixing). Mixing devices (Roll mills, High intensity internal batch mixers, twin screw extruders, static mixers: Ross ISG, Kenics).
- **POLYMERIC BLENDS.** Processing of polyblends and hybrid systems. Thermodynamic analysis. Polymers compatibilization.
- **POLYMERS DEGRADATION AND STABILIZATION.** Auto-oxidation model, photodegradation. Antioxidants, thermal stabilizers and processing aids.
- **MODIFICATION OF PLASTICS.** Lubricants, plasticizers, foaming agents.
- **POLYMERS REINFORCEMENT:** Production and structure of polymer composites and nanocomposites. Mechanics of polymer composites and nanocomposites.
- **DESIGN OF POLYMER PRODUCTS.** Polymeric biomaterials, plastic packaging materials, the use and recycling of plastics.
- **LABORATORY EXERCISES:**
 - Preparation, rheological study, characterization and moulding of plastisols.
 - Study of foaming and moulding of expandable poly(styrene).
 - Flame retardants for plastics.
 - Preparation and study of composites/nanocomposites with polymeric matrices.
 - Mechanical properties of polymers and polymer composites: i. Three point bending test, ii. Impact test.
 - Processing and study of functional properties of polymeric films.
 - Mixing and moulding using a twin screw extruder system.
 - Moulding of polymers by the techniques of injection and compression

HOURS PER SEMESTER	LECTURES	24	EXERCISES	-	LABORATORY	16	HOME-WORK	135	TOTAL HOURS: 175
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STUDENT PERFORMANCE/EVALUATION

The evaluation of the students will be done through:

- A Final (written) examination (FE), including the use of books and notes,
- Laboratory Exercises (LE),
- An Optional Report (OR).

The Final Grade results as follows:
Final Grade = 0.4 x (FE) + 0.4 x (LE) + 0.2 x (OR), or
Final Grade = 0.6 x (FE) + 0.4 x (LE)
Prerequisite: grade of the FE ≥ 5