

Second Cycle

Year 4

I4.8 Nantes COMPOSITES

Targeted professions

Research & Development engineer / Research Department engineer / Methods engineer

Core Composites Topic

Competencies to be acquired :

In the framework of sizing and manufacturing a composite component, the student will be able to :

Materials	- Identify the different physico-chemical phenomena present during the manufacture of a composite. - Identify them on a curve. - List the different techniques (LRI, RTM, prepreg, ...) for manufacturing a composite material, specifying the operating method, the functioning, the advantages and disadvantages.
Calculation – sizing	- Conduct and analyse an analytical calculation of the mechanical properties of a multi-layer fibre – resin composite material. - Analyse the results of a finite element calculation of composites.
Innovation	- Describe the ideal composite for different industries (aeronautics, naval, automobile, ...) meeting the constraints and issues of each one. - Understand the objectives to be reached in different industries (aeronautics, naval, automobile, ...).
Bibliographical research	- Carry out research for information by using resources such as the Internet and articles from specialist newspapers on a specific industrial theme. - Write a summary, quoting the sources.
Non Destructive Testing (NDT)	- Explain the different NDT techniques (sensor physics, signal processing, acquisition ...), used for composite materials, giving details about the fields of application, the advantages and disadvantages. - Conduct a NDT study (handle a tool and write a report) on a simple composite component (plate).
Recycling	- Determine the most suitable recycling method according to the industrial norms and issues. - List the industries and existing technologies and those to be created for recycling, the technological bars to raise for future recycling technologies. - Name the components of bio-composites and point out their properties (hemp fibres, linen,... and recyclable resins).
Experimental plan	Define an experimental plan. Be able to determine the influential parameters and the optimum values.
Critical analysis of calculations	- Confirm a calculation result (by comparison with other results, in a physical sense...). - Apply critical analysis to one's own work. - Argue the hypotheses of a calculation.

Organisation

The majority of the documents are in English. Some lectures/tutorials and practical exercises are in English.

Lectures / Tutorials	Reviews and aeronautical specificities • Reviews of aeronautic composites (materials and processes) + airplane (load factor, application) – AIRBUS. • Description of the materials (aeronautics, norms, methodologies) – AIRBUS. • Life cycle, choice criterion : AIRBUS Structure calculations • Review of Damaging, rupture criterion + multilayer, composite beam, sandwich – AIRBUS. • HT beam, HT sandwich – AIRBUS. Composite material shock resistance : Icam Matrix, crosslinking – EADS • Crosslinking, different materials. • Processes, interaction between the matter and the process parameters. • Physico-chemical aspect (characterisation of polymerisation state). • General behaviour of the material (thermal). Non Destructive Testing : the main defects in a composite material, the different NDT technologies, advantages and disadvantages + detail of Ultrasound technology – EADS Recycling composite materials (lecture) : Icam R&D Management, future programme : EADS
Practical Exercises	Ex 1 : creating a composite plate, draping and injection. Ex 2 : releasing from mould + cutting + NDT US + micrographic section. Ex 3 : bending test – comparison with homogenisation calculations. Ex 4 : finite element modelling of composite materials.
Project	24 hrs scheduled in the timetable. About 90 hrs of independent work by student. Groups of 4 to 6 students. Subject suggested by a business. Assessment : report and oral viva.
Extended composites topic	Lectures/ Tutorials. Durability (mainly testing) in sea environment – DCNS. Steel / composite bond – DCNS. NDT – DCNS. Fire resistance – DCNS. Repair – DCNS. Assessment : 2 hrs DS in the form of a MCQ.