

An innovative programme with the best of Academia and industrial partners: PSA, Renault, Automotive Lighting, Valeo.

The ELS training programme has been engineered and is delivered by academic and industrial faculty members selected for their know-how and expertise in the various domains identified by the industrial founders of the ELS Chair. It is organised as an academic semester followed by a 5-month internship and the writing of an industrial thesis in a company.

1st SEMESTER:

Classes, conferences, tutored personal work, experimental work and projects are organised in 6 units consisting of modules of one week each and of a 12 weeks transverse project unit.

Unit 0 / Embedded Lighting in the industry / 48 hours / 2 credits:

— Module 1:

The automotive lighting industry introduction, Research & Development.

Coordinator: **Jean-Paul RAVIER**, ELS Chairman.

Presentation of the ELS Chair.

Architecture of a vehicle in relation with lighting. Presentations of embedded lighting systems by industry specialists, visits to R&D facilities, design centres and research laboratories.

— Module 2:

The automotive lighting industry: products development & production; internships and employment.
Coordinator: **Sébastien SAUDRAIS**, ESTACA.

Visits to industrial development facilities and production lines.

Preparing internship choice: meetings with companies and their human resources departments.

Unit 1 / Fundamentals of Embedded Lighting / 117 hours / 12 credits:

— Module 1:

Fundamentals of optics for lighting
Coordinator: **Guillaume GRACIANI**, IOGS.

Description and analysis of optical lighting systems using ray optics, physical optics and basic notions on light sources.

— Module 2:

Fundamentals of photometry for lighting

Coordinator: **Isabelle RIBET**, IOGS.

Photometry of optical lighting system. Photometric measurement equipment.

— Module 3:

Systems Engineering: models and functional security

Coordinator: **Patrick LESERF**, ESTACA.

System in the automotive context, including modelling and functional reliability according to the ISO 2626-2 standards.

— Module 4:

Fundamentals of mechatronic modelling of lighting systems.

Coordinator: **Bertrand BARBEDETTE**, ESTACA.

Mechatronic system: Description with the industrial modelling tools. Ability to make and describe the assumptions of the model, to programme it, to validate it, to give a physical interpretation of its results.

— Module 5:

Creative Design of optical systems for the car industry.

Coordinator: **Mike LEVY**, STRATE.

Ability to relate the imperatives of both design and technology, to understand the point of view of the designer, to understand the origins of the constraints generated by the design and to be able to propose technical recommendations to meet the design specifications.



Unit 2 / Advanced optical design of lighting systems / 48 hours / 6 credits

— Module 1:

Light sources: properties & performances, integration, reliability.
Coordinator: **Gaelle LUCAS-LECLIN**, IOGS.

Light sources selection according to technical specifications under constraints.

— Module 2:

Computer aided photometric design of illumination systems.

Coordinator: **Lionel JACUBOWIEZ**, IOGS.

Broad knowledge of the main optical components and sub systems used in lighting and signalling. Ability to design and optimise the photometry of a lighting systems using a dedicated software.

Unit 3 / Advanced engineering and integration of lighting systems / 76 hours / 9 credits:

— **Module 1:**

Integration of the physical system environment and production constraints.

Coordinator: **Bertrand BARBEDETTE, ESTACA**

Ability to understand the diverse technical environments, to size the system with the fabrication process constraints.

— **Module 2:**

Mechatronic modelling and simulation of an embedded lighting systems.

Coordinator: **Rabia SEHAB, ESTACA.**

Ability to model the mechatronic systems, to program them and to validate them with simulations or prototypes.

— **Module 3:**

Embedded information systems.

Coordinator: **Sébastien SAUDRAIS, ESTACA.**

Ability to program an electronic board, to describe the information path necessary for its control, to correctly send and receive a network message.



Unit 4 Visual aspects and cognitive vision with advanced simulations / 48 hours / 6 credits

— **Module 1:**

Characterisation of surfaces and of their aspect, advanced photometric simulation of surfaces.

Coordinator: **Xavier GRANIER, IOGS.**

Ability to use advanced tools for realistic simulation of photometry, and visual aspect of a lighting system. Ability to relate the characteristics of surfaces to their expected and observed visual aspect and to use the relevant characterisation tools.

— **Module 2:**

Physically realistic and real time rendering of appearance, visual and cognitive aspects in relation with design.

Coordinator: **Mathieu HEBERT, IOGS.**

Understanding of the relationship between the physical reality and the perceived aspect. Ability to specify the needs in terms of real time rendering by virtual or augmented reality as well as by valid images through the filters of vision and cognition.

Unit 5 / Transverse project 80 hours / 10 credits

Coordinator: **Sébastien SAUDRAIS, ESTACA.**

One day per week, on a project using the diversity of the studied fields

2nd SEMESTER:

Unit 6 / Internship Semester / 30 credits

Coordinator: **Bertrand BARBEDETTE, ESTACA.**

Practice of the outcomes on an industrial project in a professional environment from Mid February to End July.

The Chair Manager processes internship proposals from the companies. Student may then apply and an internship agreement is signed between the company, the student and one of the academic partners of the ELS Chair.

The intern is tutored internally by a company representative and coached by an academic tutor from the ELS chair.

The evaluation of the internship is done on the basis of an evaluation by the company tutor (50%), the evaluation of the written internship thesis (25%) and an oral defence (25%).