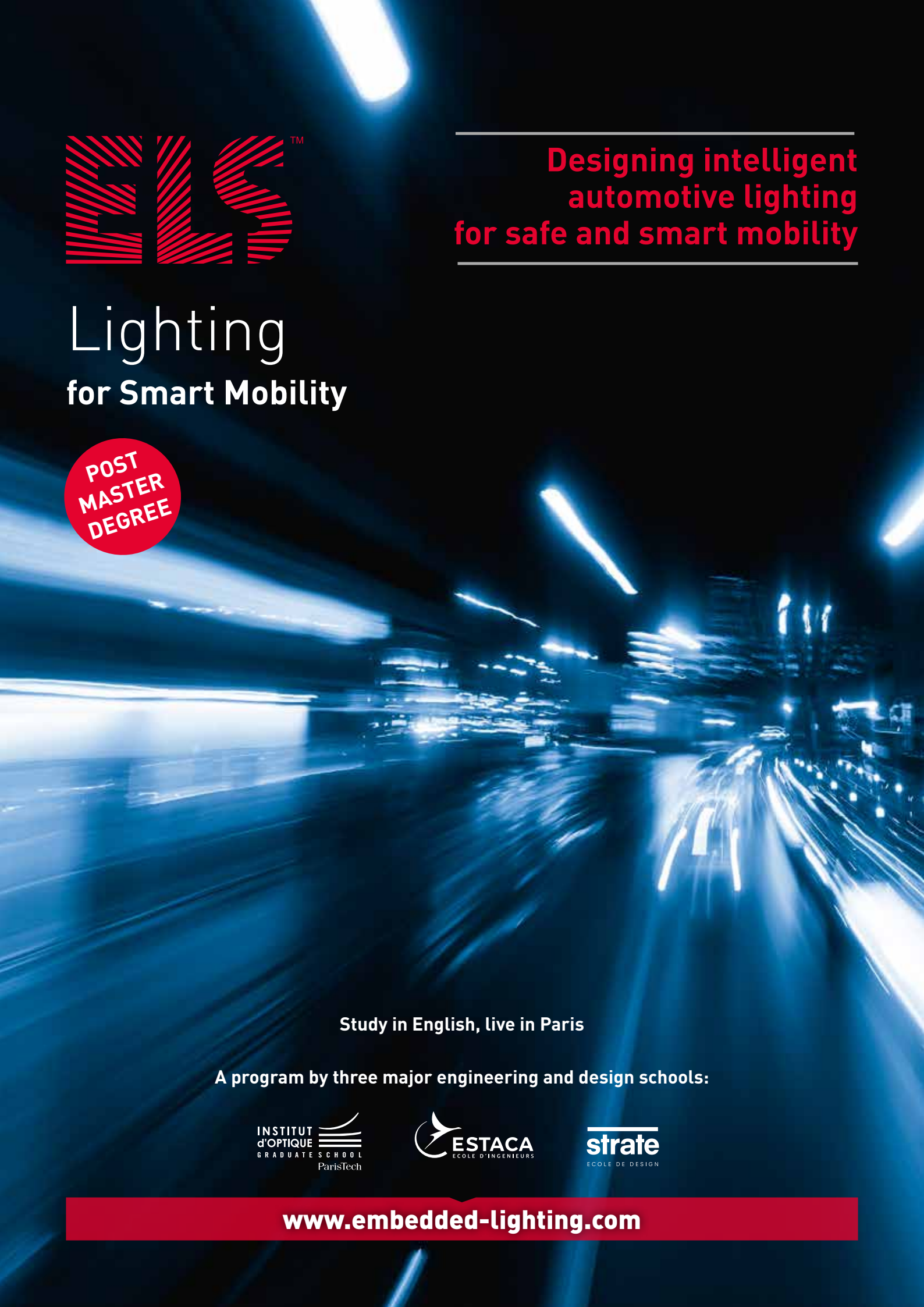
ELS™
Designing intelligent automotive lighting for safe and smart mobility
Lighting
for Smart Mobility
POST MASTER DEGREE
Study in English, live in Paris
A program by three major engineering and design schools:
INSTITUT d'OPTIQUE GRADUATE SCHOOL ParisTech
ESTACA ECOLE D'INGENIEURS
strate ECOLE DE DESIGN
www.embedded-lighting.com

A unique program
for the quickly evolving automotive lighting challenges

The automotive lighting sector is currently undergoing major changes with the development of new technologies such as Matrix LED, Laser, OLED lights etc., as well as advanced and intelligent lighting functionalities. Smart, shared, connected and autonomous vehicles are now requiring to reinvent the whole concept of lighting for the future of mobility, with new designs and engineering. The next frontier is to generate digital and smart lighting solutions for safety, customers' experience and human-car interaction. The ELS Post-Master program provides an integrated approach from design to engineering of automotive lighting.

The program at a glance

→ AIM

- To train future project managers, department managers and experts in the field of lighting systems
- To provide an integrated vision from design to production including:
  - Creative design
  - Optical, mechanical and system design
  - Simulation and virtual prototyping
  - Embedded power and intelligence for smart vehicles

→ PROGRAM BENEFITS

- Delivered by higher education institutions in optics/photonics, embedded systems and design in Paris area, in France
- Accredited by CGE - Conférence des Grandes Écoles (France's top-ranking Engineering Colleges): the "Post-Master" (Mastère spécialisé©) undergoes a rigorous accreditation procedure that guarantees the program's quality
- Run by leading experts in the field of vehicle embedded lighting systems
- Tailor-made to suit industry needs
- Engineered with the strong support of industrial partners
- Participation of professional experts
- Fascinating career prospects in a sector currently hiring highly qualified graduates

→ PROGRAM SCHEDULE

- Academic coursework and tutored team project: 400 hours (from September to end of December)
- Professional thesis based on 6-months minimum of in-company operational training (from January to end of June)

→ ASSESSMENT

- Teaching modules assessed with exams and labwork
- Academic team project assessed via dissertation and defense
- Professional thesis assessed via dissertation and defense

The ELS Post-Master helped me to have a broad, transversal scope of our worldwide automotive industry and automotive lighting design. I understand better the challenges faced by my colleagues from the mechanics and optics departments, as well as the ability to anticipate the wants and needs from our customers. This Master has benefited my career in the automotive lighting industry. Following this training, I have been promoted from System engineer to Electronic Design Leader (EDL) and now to EDL team leader.

Cameron Betz, USA

→ JOB PROSPECTS

A wide range of positions is accessible after completing the ELS Post-Master in the automotive value chain (car manufacturers, lighting systems and components suppliers, and engineering service providers...) such as:

- Project managers
- Product leaders
- R&D engineers
- Lighting experts

The integrated approach valuing cross-disciplinary theoretical and practical knowledge is extensively sought after by automotive employers.

→ COURSE BREAKDOWN

Lectures, labwork, team project and management.

→ NUMBER OF CREDITS

75 ECTS (European Credit Transfer System)

→ LANGUAGE

English

→ LOCATION

The ELS program takes place in the heart of the research-intensive and innovation cluster of Paris-Saclay offering diversified scientific and technological potential. Classes, tutorials and labwork are hosted at ESTACA (Saint-Quentin-en-Yvelines), Institut d'Optique Graduate School (Palaiseau) and Strate - École de Design (Sèvres).

Syllabus

	Module	Learning outcomes	Hours
FIRST SEMESTER - *45 credits*			**400**
Unit 0	**Awareness of the Embedded Lighting industry** - *2 credits*		
Module 1	The automotive lighting industry introduction, Research & Development	Presentation of the ELS Chair. Introduction to the history of automotive lighting. Visits of ELS Partners	27
Unit 1	**Fundamentals for understanding embedded lighting systems** - *12 credits*		
Module 1	Fundamentals of optics for lighting	Description and analysis of optical lighting systems using ray optics, physical optics and basic notions on light sources.	24
Module 2	Fundamentals of photometry for lighting	Photometry of optical lighting systems; photometric measurement equipment.	20
Module 3	Design in automotive lighting systems	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.	24
Module 4	System engineering, functional safety and regulation in automotive lighting systems	System in the automotive context, including modeling and functional reliability according to the ISO 2626-2 standards.	19
Module 5	Fundamentals of the modeling of mechatronic lighting systems	Presentation of mathematical approaches for modeling a multi-physical system; initiation to numerical mechatronic modeling tools; ability to propose and describe the model requirements, to program the model, to validate it, to give a physical interpretation of its results.	24
Unit 2	**Optical design of lighting systems** - *6 credits*		
Module 1	Light sources: properties & performances, integration, reliability	Light sources selection according to technical specifications under constraints.	26
Module 2	Computer aided photometric design of illumination systems	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 system using a dedicated software.	24
Unit 3	**Transverse project** - *10 credits*		
Project 1	Benchmark/Design Project	One day per week, on a project using the diversity of the studied fields, with a benchmarking analysis and a research project.	24
Project 2	Transverse project		70
Unit 4	**Engineering and integration system for lighting systems** - *9 credits*		
Module 1	Integration of system and process environment constraints	Ability to understand the diverse technical environments (thermal, vibration, crash,...), to size the system with the fabrication process constraints (plastic injection, metallization, ...).	23
Module 2	Modeling and simulation of a mechatronic lighting system	Ability to model mechatronic systems, to program them and to validate them with simulations or prototypes.	24
Module 3	Embedded data systems	Ability to program an electronic board, to describe the information path necessary for its control, to correctly send and receive a network message.	24
Unit 5	**Cognitive and visual aspects** - *6 credits*		
Module 1	Characterization of surfaces and of their aspect, advanced photometric simulation of surfaces	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.	26
Module 2	Physically realistic and real time rendering of appearance, visual and cognitive aspects in relation with design	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.	21
SECOND SEMESTER - *30 credits*			
Unit 6	**Internship Semester** - *30 credits*		
Module 1	Practice of the outcomes on an industrial project in a professional environment from January to June	The intern is internally tutored 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 defense (25%).	6 months

An innovative program
with the best of academic and industrial partners

→ THREE MAJOR ENGINEERING AND DESIGN SCHOOLS

A world leader in photonics

The Institut d'Optique Graduate School, or "SupOptique", is an engineering Grande École, a member of ParisTech and part of Paris-Saclay University.

Founded in 1917, it is one of the major players in higher education and research in optics and photonics in France. Its international influence is based on the quality of the training provided, the major scientific contributions of its research centre and its close links with industry.

Researchers at the Institut d'Optique and its three laboratories, located across a national campus (Paris-Saclay, Bordeaux, Saint-Etienne) publish an average of one article a day and are cited thirty times daily.

www.institutoptique.fr

A major European actor in the field of transports and mobility

Founded in 1925, ESTACA Graduate School of Engineering is highly specialised in the fields of aeronautics, automotive, space and railway industries. ESTACA is a member of ISAE group, 1st world cluster in aerospace training and research. Through innovative pedagogy and with its rapidly developing research center, it trains industrial engineers known for their technological know-how. ESTACA's graduates undertake the design, development and production of transport systems and components. The industry has ranked ESTACA among the best engineering schools for its expertise in the transportation fields.

www.estaca.fr

One of the best transportation design schools in the world

Created in 1993, Strate School of Design is one of the best Transportation design schools in the world. There is not a single car company without Strate alumni. Strate trains transportation designers for tomorrow, capable of developing a transversal and global vision of all mobility issues with a two-fold objective of formal and conceptual excellence.

www.strate.design

→ A PROGRAM SUPPORTED BY LEADING INDUSTRIAL PARTNERS

Founding partners

Associate partners

Admission
Information

→ ELIGIBILITY

- All students holding a Master of Science (preferably in scientific fields). Applicants must prove an engineering degree recognized by the Commission des Titres d'Ingénieurs (Commission for Engineering Degrees), or a Master degree or equivalent, or a foreign degree equivalent to one of those
- English language proficiency at the B2 level (minimum paper based TOEFL: 575 or TOEIC: 785)

A limited number of applications, not fulfilling the degree criteria but with outstanding achievements can be considered.

→ TUITION FEES

- 13.000 Euros: full fee
- 10.000 Euros: reduced fee for recent graduates

→ TUITION WAIVERS

Waivers for tuition fees are available for a limited number of students

→ ADMISSION PROCESS

- Admission upon application followed by an interview (can be conducted by webconference)
- Application period from February 15th to June 30th
- Online application on the website: **http://embedded-lighting.com/admissions/**

→ TIMETABLE

- Application period from February 15th to June 30th
- Course: September to end of December
- In-company operational training: January to end of June

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Visit our website **www.embedded-lighting.com**