THE ENSPS

THE NATIONAL SCHOOL OF HIGHER EDUCATION OF PHYSICS OF STRASBOURG

école nationale supérieure ensps de physique de Strasbourg

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ulp UNIVERSITÉ LOUIS PASTEUR STRASBOURG

CONTENTS

The ENSPS, Polyvalent Engineering School

The ENSPS – the National School of Higher Education of Physics of Strasbourg, a school for training engineers, is a part of the Louis Pasteur University. The school is a member of the "Conference des Grandes Ecoles" (a select group of schools of higher education in France) and of the technical colleges that require the students to pass an entrance examination.

The aim of the ENSPS is to train polyvalent engineers for three years who are creative and are able to put their knowledge of physics into practise.

To reach this goal the school is equipped with high-tech multimedia equipment (video conference rooms, internet access and e-mail for all the students, computer rooms etc.).

Although the main role of the engineering school is to train engineers, at the same time it is involved in scientific research, both alone and in partnership with other departments of the university, the CNRS (National Centre for Scientific Research and industry in symbiosis. The research activities at the ENSPS are mainly related to engineering physics.

As a breeding ground for engineers at the forefront of its specialities and as a centre of fundamental and applied research, the ENSPS is also an active centre of technological exchange. The school is situated in the "golden triangle" of European research bounded by Alsace, Baden-Wurtemberg and Switzerland. In a 400 km radius of Strasbourg can be found a large slice of European scientific potential. Rich in high-tech industries, this border region has its own international and technological exchange.

The Pedagogical Project

The aim of the school is to train engineers in research and development in the field of physics and to make them capable of understanding, mastering and solving technological problems, which are not only posed in the world of industry, but also in research laboratories.

To reach this goal we have developed a pedagogical project which we will present on the following pages.

The solid foundation that is acquired by our students during their three-year course at the school prepares them for a variety of related activities such as automation, electronics, computer science, image processing, photons, material physics, biological and medical engineering, as well as astrophysics, fundamental physics, nuclear physics etc.

At the same time, because of the "general" character of our course the students have no difficulty in adapting to other technological fields.

Our collaboration with other French or foreign establishments gives the students who wish the possibility of doing their third year in another technological sector.

Our education consists of :

➢ Traditional teaching

Class work, supervised work, practical work

The school provides lecturers who give the students the theoretical and practical scientific foundation necessary for all future engineers. The education is composed of a foundation course and a choice of subjects. During the third year the student is offered several different options which allow him to go into a subject in more depth.

Options offered :

- Capturing and image processing
- Integrated sensor electronics and system simulations
- Software engineering, systems and networks

- Automation engineering and vision systems
- Engineering and life sciences
- Phonics
- Physics and modelling

• Industrial projects

Small groups of students, supervised by a tutor from the school, carry out a project requested by a “client”, a manufacturer or a laboratory. Throughout the development of the project there are regular progress meetings and at its conclusion there is a presentation in front of the client and tutor based on a public and technical project report.

➢ A specific education in communication and human resources management

Learning to communicate in industry

From the outset at the school the students learn with specialists in communication how to participate in meetings and how to lead a work group.

Foreign language learning
In todays world the ability to communicate in English is absolutely essential. The students are required to reach a certain level of English in order to be able to pass an international examination. Apart from this a second compulsory language can be chosen from a large choice such as: German, Spanish, Japanese, Italian etc.

Training for company management
Company management courses include an introduction to accounting, production management, human resources and the management of national and international projects.

➢ Practical placements in companies in France and abroad

There are three compulsory training periods during the degree course at the end of which two reports and a final dissertation must be presented. This experience of the world of work is for a total minimum period of 32 weeks.
We encourage our students to complete at least one of the training periods abroad.

➢ Learning through research

All our students have the possibility of pursuing a DEA (Post-graduate diploma in preparation for a PhD) based on the option they have chosen for their speciality and continuing, if they wish, to a doctorate. This opening into research is made possible through the laboratories at the school where there are more than 300 researchers at work and at the internationally renowned research laboratories of the University Louis Pasteur.

➢ International relationships

With the location of the school being in Strasbourg, the capital of Europe and on the border of France and Germany it has all the possibilities of being able to offer its students an opening to other cultures.
We encourage our students to live abroad through participation in training periods, a year of studies or a sabbatical year in a professional environment.

Through numerous international agreements we have links with other universities which encourage international pedagogical projects.

To implement the pedagogical project the teaching at the school is composed of :

- the foundation course
- selective courses
- industrial projects

- options
- practical placements
- learning by and with research

The Foundation Course

Throughout the degree course the student is taught to be more and more autonomous in the management of their work.

The foundation course covers two terms of the first year and the first term of the second year. It is composed of 1710 hours of classes including the project work. The objectives of this part of the degree course are the following:

- a fundamental education in the speciality of the school – physics
- a computer engineering course
- an education in science subjects for engineers
- courses in arts subjects (languages, communication, business studies)

➢ Fundamental course in physics

The aim of this course is to provide a complement in modern physics to the knowledge already acquired in the preparatory classes. The student has the possibility of doing experiments during the practical and supervised work which run alongside the class work. The direct application of such an education is carried out through the projects in the first and second years.

General Physics - 222 hours	
Atomic physics	35
Material physics	35
Electromagnetism	35
Statistical physics	35
Photometry, radiometry, optics	23
Transmitters, receivers	28
Fluids mecanics	31

Personal work - 330 hours	
Practical work	80
Projects	250

➢ Education in computer science

It is essential today to be able to use a computer. We therefore educate our students in different techniques of programming and computer engineering.

Computer science - 129 hours	
General computer science	17,5
Programming (C, C++, unix, java)	63,5
Computer engineering	20
Microprocessors	28

Practical work - 80 hours

➢ Education in science for the engineer

After a complementary course in mathematics the domain of science for the engineer is attained, essential today for carrying out industrial projects. This part of the course includes the subjects based on electronics and system engineering.

Mathematical tools - 146 hours	
Mathematics	35
Statistics and probabilities	35
Signal processing	76

Electronics - 157 hours

System engineering - 80 hours

Personal work - 198 hours

Practical work	148
Projects	50

➢ Education in arts subjects

At the end of their preparatory classes most students have little knowledge of the engineering profession in which they wish to enter. The different aspects that this occupation can assume in companies are presented during the first few weeks in seminars given by engineers from different companies. Following this we broach the problems of communication in companies, accounting, human resources and production. Throughout the whole degree course the students take foreign language courses. (Two languages are compulsory)

Compulsory languages - 244 hours
(of which 122 hours of English)

communication	18
Accounting	20
human resources	20
production management	20
international management	28
quality control	16

Selective Courses

In order to allow the students to differentiate between different career possibilities and to make a clear choice of their option, a selection of subjects is proposed.
During the second term of the second year the student must choose between three modules each of 25 hours to be chosen between several subjects. Furthermore they complete a personal assignment which directly prepares them for their future option.

➢ Selective courses in the second year

There are three courses to choose between :

Automation	25 hours
Electronics	25 hours
Image processing	25 hours
Physics	25 hours
Photonics	25 hours
Signal and communication systems	25 hours
Biological and medical engineering	25 hours
Calculus	25 hours

➢ Personal work based on one of the selected modules 60 hours

In the third year there is also the possibility of choosing two modules from four that are offered of 12.5 hours each.

➢ Selective courses in the third year

Two courses to choose from

Multiprocessor systems	12,5
2D and 3D vision	12,5
Networks	12,5
Electromagnetic compatibility	12,5

Industrial projects

The projects are often led by a collaboration with industrial partners following certain specifications. They offer an opening for the future engineers by placing them face to face with a real client. They aim at developing the autonomy and the sense of responsibility of the students.

The projects are carried out in-house under the supervision of a lecturer who often has an industrial background. They provide a real opportunity to work in a team and at the same time autonomously, a concrete experience of managing a project by learning the notion of sharing roles and of leadership, involvement and responsibility.

The types of projects are varied and multidisciplinary. They are often derived from real industrial problems and allow the students not only to apply their knowledge in the most realistic situation as possible such as keeping to the constraints, the time limits, the necessity of producing results and integrating different techniques, but also to respect the economic, social and human aspects that lie behind all activities and projects in business.

An original feature at the ENSPS consists in co-ordinating a number of group projects and spreading them out over a few successive years.
The advantages of this method are the following :

- to make the projects more cooperative, thereby emphasising the importance of the co-ordination and communication.
- because they are carried out over a longer period than an academic year they are more realistic, which corresponds to the industrial world.

The overall result of this type of education produces work that is more realistic, more motivating, more important and allows each student to identify with the results of the whole group. This, of course, can be mentioned in their cover letters when applying for a training period or a job.

In the first year the project is carried out in pairs with 100 hours of work per student.
In the second year it is a team project with between three to six students each working for 150 hours.

Training Periods

The study programme includes one training period per year with a minimum duration of :

- **4 weeks at the end of the first year**
- **8 weeks at the end of the second year**
- **20 weeks incorporated during the third year, including the final project**

Altogether the training periods represent a minimum of 32 weeks of which the students must complete 8 weeks in a company.

In the first and second year the training periods are carried out between the end of June and the end of September.

Although in the first year the placement is often their first contact with the professional world, by the end of the second year the students are ready to tackle most of the technical tasks of the engineer. The work that they are required to do is therefore the work of the engineer that is well-defined and determined. This should allow them to put into practise the theoretical knowledge they have acquired by carrying out concrete applications in an industrial environment.

In the third year the final project is carried out from March to September
From March the students execute their final project in companies or exceptionally in a laboratory for a minimum of 20 weeks, leading up to a dissertation and viva voce at the school in September. The standard of work required is equivalent to that performed by a novice engineer.

➢ Organisation

The training periods for the student engineers are organised by the practical placement department of the school. This department performs three main functions:

- locating and preparing placements
- monitoring the trainees
- the conventions for training periods

➢ The location and preparation of practical placements

The students are required to find an organisation for their training periods on their own. This process should be done by following the pedagogical guidelines as given by the school. The preparation includes meetings explaining the objectives of the training , their development, the way to prepare a report etc.

➢ Monitoring the trainees

During their training periods the student engineers continue to be part of the school and keep in permanent contact so as to be able to ask for help or advice at any moment.
For the final project the school designates a lecturer who is responsible for each trainee.
This lecturer acts as an intermediary between the school and the company and contributes to a successful development of the training.
What is more, towards the end of April or beginning of May the trainee should prepare a preliminary report on the progress of their work.

➢ Conventions for practical placements

Each training period is governed by a convention or contract signed by the person responsible for the laboratory or the company, the head of the school and the student.
For the final placement in the third year the subject for the training period must be validated by the teacher responsible for the option before the contract can be signed.

The options

It has been seen that during the second term of the second year the students are offered a number of optional courses through which they are able to become acquainted with several different subjects before specialising in one of them in the third year. In the first term of the third year the students can choose between seven options.

- Image capturing and processing
- Electronics in integrated sensors and system simulations
- Software management of systems and networks
- System engineering, automation and vision
- Engineering and physical life sciences
- Photonics
- Physics and modelling

These different options cover about 250 hours of classes from October to February.

Image Capturing and Processing

This option course is compatible with the preparation for the DEA (Pre-PhD post-graduate diploma) in photonics, image and cybernetics, the image processing option and the DEA in computer studies.

➢ Aims and means

The recent progress in computing and microelectronics enable us to envisage how sophisticated applications using database imaging are used more and more in a great variety of fields such as in industry, medicine, the management of natural resources etc. Multidisciplinary image processing and its applications are used in such diversified scientific fields as physics, instrumentation, computing, new computer technology and communication.

After having acquired during the first two years of the course a solid foundation in physics, electronics and computing, the students have the possibility during their third year of following a specialisation option in image processing and its applications. The specific aim of the image capturing and processing option is to educate the students in the different approaches to the mechanism and systems that are needed for its application. This approach enables the students to learn how to apply all the different aspects of image processing, capture and their associated electronic mechanisms as well as enabling the future engineers to be integrated in multidisciplinary teams. By the end of their degree course they will have been shown the techniques for interpreting and processing, particularly in the field of computer vision, metrology, medical imagery and remote sensing.

This option is based on a complementary approach between:

- A physics based education of mechanism acquisition: learning about images and sensors.
- An education directed towards engineering sciences that are needed for the processing and acquisition of digital images.
- An in-depth education in specialised field applications carried out in the laboratories located at the school.

➢ This option is supported by

- The computing facilities at the school
- The research laboratories that have close links with the school and are interested in imagery (the Laboratory of Image Science, Computing and Sensing, the Institute of Biological Physics and the Physics Laboratory of Semi-conductor Applications - Group of Applied Optics) .
- Regional organisations specialised in the field of imagery, for example, the Regional Laboratory of Ponts and Chaussées, and company partners, in particular, Alcatel Business Systems.

Courses

1) Basic tools : 91 hours

Training in imagery	18
Image sensors and mechanisms	15
Two dimensional signal processing	18
Basic tools in image processing	20
Basic tools in computer vision	10
Image geometry and synthesis	10

2) Development and transmission of images : 66 hours

Classification methods	8
Image analysis and sequencing	24
Linking and stochastic methods	12
Problems of inverted imagery	10
Image codification and transmission	14

3) Applications : 80 hours

Sensing	15
Medical imagery	15
Industrial vision	15
Practical applications	35

Electronics in integrated sensors and simulation of systems

This course option is compatible with preparation for the DEA in instrumentation and microelectronics.

➢ Aims and means

Electronics has developed in leaps and bounds since the invention of the transistor, which the engineer can assemble together with millions of other components and engrave onto a silicon plate of a few square millimetres. These integrated circuits or microchips manipulate electronic signals in an analogue or digital form to perform a variety of functions such as: amplification, filtering, coding, decoding, calculations, memorisation etc. They are assembled and interconnected on printed circuit boards to form complex systems needed for an application or a particular task. Based on their knowledge of physics, the theory of circuits and manufacturing techniques the electrical engineer designs these circuits and systems by means of the computer for the dimensions and arrangements of the components. The preliminary simulation performed on the computer enables us to carry out a virtual test of the functioning of the circuits and make improvements to them before their manufacture.

➢ The aim of this course option is to

- Supplement the knowledge acquired in engineering science of the first two years
- Give a wide scientific and technical training, not only in microelectronic technology but also in traditional analogue and digital electronics
- Provide an efficient preparation for the future career of an engineer in giving them the knowledge to be able to adapt rapidly to the main fields in electronics and their development

➢ This course is supported by

- The ENSPS facilities in electronics and computing
- The facilities and know-how of the most important research laboratories of the CNRS and the University Louis Pasteur
- The collaboration of local industrial participants
- Complementary courses provided under the auspices of the DEA in “Instrumentation and microelectronics”

Courses(in hours)

Physical chemistry of components	12
CAO methodology	10
Algorithmic for electronics	10
Complementary electronics	68
Microelectronics	30
CAO elementary component models	9
Scientific presentations	14

Optional Courses

Testing of analogue and digital concepts	30
Implementation of design tools	27

or

Technology of components	24
Characterisation of elementary mechanisms	18
Technological simulations of components	15

Software Management of Systems and Networks

This course option is compatible with the preparation for the DEA in computer engineering.

➢ Aims and means

The continuous progress in microelectronics and computing leads more and more often to the development of complex applications in a great variety of fields. These applications require multidisciplinary skills from very diversified areas of computing and science such as : physics, instrumentation and engineering. This option gives a double profile of competence in applied physics and computing and guarantees qualified students a large variety of choice of positions in industry and research and development.
Having provided the students with a solid foundation in physics, electronics and computing in the first three terms of the degree course, this third year option is prepared in the final term of the second year by a lecturer specialised in computer science. This leads in the third year to a specialisation in software management for networks and systems. The aim of software management for networks and systems is to teach the students all the methods and systems necessary for computer applications and to allow them to become adept in fundamental concepts in computer science such as: programming, algorithmic, software management, digital technology and modelling etc.

The idea of this option therefore, is to enable future non-specialised engineers and high-level computer engineers to be integrated in multidisciplinary teams. By the end of the degree course they will have the necessary knowledge of computer techniques to be able to join research and development teams in industry to help develop their applications.

This option uses therefore a complementary approach between :

- an education based on physics and modelling (first and second years)
- an education directed towards engineering sciences as well as computer science (second and third years)
- in-depth study in computer orientated systems (third year)

➢ The option is supported by

- the school's computer facilities
- the computer department of the Louis Pasteur University
- public research laboratories close to the school and active in the field of computing, for example the Laboratory of Science and Image, Computing and Sensing.
- regional organisations interested in computer science and its application, and company partners, particularly Alcatel Business Systems.

Courses(in hours)

1) Computer science complement (second term of the second year) **75**

Digital technology analysis
Algorithmic
Data basis
Software management

2) Personal work in computer technology, complemented by programming languages **60**

3) In depth third year course **243**

Systems and software management
Advanced networks
Discrete geometry
Artificial intelligence
Systems for discontinuous events
Practical work

System engineering, automation and vision

These options are compatible with the DEA preparation in photonics, imaging and cybernetics.

➢ Aims and means

Automation is the art of analysing, modelling and thereby controlling systems. It concerns with information and making decisions.

The applications in this field are as numerous as they are varied: mechanical engineering, electromechanical engineering, electronics, biotechnology, space industry, processing industries, robotics, medicine and economy.

The objective of the system engineering, automation and vision course is to train engineers, who, having already acquired the ability to use the most sophisticated tools in modern automation and having an extensive general knowledge, are able to tackle applications in a variety of fields such as those mentioned above ; taking advantage of the special knowledge necessary for image processing. This subject also plays a significant part in the field of the control systems for artificial sight.

➢ This course is composed of

- a theoretical part covering advanced automation tools and the “system” engineer from the representation and identification of systems to their control
- a practical part concentrating on robotics, artificial vision and the command of complex systems as well as real time computing, on-board computing and networking.
- Two new areas for automation application were developed in Strasbourg a few years ago, biogenetics and medical robots. This course, of system engineering, automation and vision, is therefore particularly adapted to the developments in this field.

➢ The course is supported by

- the Science Laboratory of Image, Computing and Sensing (LSIIT), a combined unit of research at the ULP and the CNRS or more specifically their research group in Automation and Robotic Vision (GRAVIR)
- the Technological Research Team (ERT) of transport and high speed flexible material coils possessing a very well equipped technological platform. other scientific laboratories in Strasbourg: such as the Institute of Genetics, Biological Moleculaires and Cells (IGBMC), a partner of Génopole of Strasbourg and the Institute of Cancer Research on the Digestive System (IRCAD)
- a strong international collaboration, in particular with the universities and companies in Germany (Gerhard-Merkator University, Gesamthochschule Duisburg, TU Karlsruhe, Siemens, Bosch) as well as some American Universities such as the University of Minnesota and the University of Maryland)

We can also add to this list for their help in providing placements for training periods well-known French and European companies such as EADS, Airbus, EDF,PSA,Peugeot, Citroen, Renault, Compagnie Rhénane de Raffinage, Shell, Eurocopter, General Motors, Siemens and ABB.

Engineering and Physical Life Sciences

This option course is compatible with the preparation for the DEA in Mechanics and Engineering

➢ Aims and means

The option of Engineering and Physical Life Sciences at the ENSPS prepares the physic engineer for the developement and implementation of all products and services concerned with physics and life sciences.
The part of the course concerned with life sciences is particularly directed towards living macroscopics.

This combination of courses leads directly to professional possibilities in fields such as medical imagery and its applications, biomechanics, modelling and the identification of linear and non-linear dynamic systems.
This option provides an indispensable engineering complement for the engineer who wishes to work with projects and applications in life sciences. These applications are not only involved with health but also transport and sport.
The aim of this course is to educate the physical engineer in :

- Understanding and preparing models in physics and biological processes directed towards the interface from microbiology to macrobiology.
- Being able to implement instruments adapted to functional clinical examination and medical imagery.

The course is divided into five parts

- Biological and medical engineering (GBM), comprising physiology, functional clinical examination instrumentation, the study of problems of bio-compatibility, as well as the rules and technical conditions of a hospital
- Mathematical models in life sciences
- Biomechanics
- Imagery in life sciences, comprising the physics of imagery, the techniques and uses of image processing, its implication for virtual surgery and surgery at a distance.
- Life sciences and decision making including the study of perceptive and sensorial processes in man

➢ The means

The courses are given, on the whole, by specialists from the relevant laboratories of the University Louis Pasteur, CNRS, the INSERM or companies working in areas related to biology such as the Institute of Solid and Fluid Mechanics, the Institute of Biological Physics, the Department of Psychology, the Institute of Computers and Systems of the University of Pavie, Italy, INSERM 338, General Electric Medical Systems etc.

Courses

1) Biological and medical engineering	**78 hours**
Physiology	30
Instrumentation	40
Technical conditions	8
2) Life science modelling	**92 hours**
Theory of systems	16
Biological cybernetics	40
Biosystems	18
Biomechanics	18
3) Living images	**45 hours**
4) Information processing	**22 hours**
5) The expertise of TP systems	**12 hours**

Photonics

This course option is compatible with the preparation of the DEA in photonics, imagery and cybernetics.

➢ Aims and means

Modern communication, measurement and production industries depend more and more on photonics. According to the latest report from the Academy of Science of Optics and Photonics, photonic is a growing technology which is incorporated in an increasing number of products being developed. The significant development in the industrial sector in photonics therefore opens new horizons for young engineers. The recent break through in photonics concerns not only telecommunication and the media but also the use of lasers, sensors and measuring devices. The trend is towards integration and miniaturisation, MEOMS (micro electro optical mechanical systems) and photonic microhips.

The aim of the photonics course at the ENSPS is to educate engineers, who already have a solid foundation in physics, electronics, computing and automation, in the different aspects of photonic systems and microsystems and thereby give them access to a great variety of careers. Career opportunities are just as good in the industrial sector, where 60% of former students are working, as in institutions such as CNRS, CEA, Universities, international research centres etc. with 30% of former students and with 10% in consulting or other fields.

The course consists of

- foundation courses in the interaction between light and materials
- courses directed forwards methods, procedures, devices and micro devices in photonics and their applications
- guided projects
- practical work providing a working knowledge of this speciality.

➢ Collaboration on the course

- Among the cross-border participants associated with the projects, the practical work and training periods we find principally the CEA, the CNRS, Offenburg University of Technology, The University of Fribourg, through their laboratories and research centres concerned with photonics.
- Amongst the industrial partners providing practical placements for the students we find principally, Alcatel, PSA, SAGEM, THALES, AGILENT, FRANCE TELECOM and THOMSON Multimedia
- GIFO, French Industrial and Optics Group, provide practical placements to ENSPS students in their second and third year of the photonics course.

Courses(in hours)

Physics of lasers	15
Interaction between light and materials	15
Non-linear optics	18
Metrology optics	34
Photonic processing of signals and matter	15
CAO components and optic systems	15
Guided optics, telecommunications and sensors	15
Networks and fibre optics in optical electronics	25
Laser manufacturing and photonic power	20
Microphotonics	20
Optical-computing	23
Practical work	41

Physics and modelling

The courses in this option are compatible with the preparation for the following DEA

- Astrophysics
- Applied mathematics
- Physics of matter
- Subatomic physics

➢ Aims and means

Most of the important technological advances recently made are based on the application of developments in research in physics and computing. Optical electronics and nuclear technology are examples of these. The extraordinary success of the computing sector and its services, for example, digital simulation, multimedia applications would never have been possible without a solid foundation in physics in microelectronics and CAO (Computer Assisted Conception) of the associated architecture.
In the same way, every time a project is carried out and, above all, when an industrial object has reached the prototype stage as for example, an aeroplane or an experiment, a satellite mission or the physics of particles where there has been a large investment, a complete preliminary simulation is carried out.

The objective of this course option is to educate the engineers who will master both a large area of physics and the pertinent knowledge in computing of digital simulation. These studies, compatible with the DEA in physics and mathematics at the University Louis Pasteur will allow them to work for a PhD in public or industrial research laboratories.
Until recently most of the work in digital simulation in physics has been in the fields of mechanics fluid, resistance to materials and the physics of nuclear reactors. The research being carried out in the laboratories of the CNRS and the ENSPS widens these areas to include the simulation of quantum components, a crucial field for the development of microelectronics of the future

➢ Course support

All the laboratories associated with DEA in physics and mathematics in Strasbourg

- Institute of physics and chemistry of materials at Strasbourg
- Institute of subatomic Research
- Laboratory of physics and applications to semi-conductors
- The Charles Sadron Institute
- Laboratory of complex fluids
- Laboratory of theoretical physics
- The Strasbourg Astronomical Observatory and main laboratories related to this sector.

This support is also essential for entering the industrial research laboratories such as Alcatel, IBM, Matra, Philips, SGS - Thompson and Siemens.

Courses

1) Specific courses for this option — **100 hours**

Quantum mechanics, non-linear physics	40
Computing : parallel calculus	20
Modelling and digital simulation	40

2) **Courses in common with the DEA and DESS programmes of the University Louis Pasteur** — **140 hours**

Courses that are chosen by the option director from amongst the following DEA and DESS programmes **:**

- **DEA physics of condensed matter materials, nanostructures and soft matter**
- **DEA analysis and data processing in the field of astrophysics**
- **DEA subatomic physics, modelling and instrumentation**
- **DEA mathematics**

- **DESS mathematics for industry**

Education through research

During the first term of the third year, at the same time and complementary to their engineering course, any students who wish can follow a DEA programme together with their chosen option. Amongst the DEA courses offered are the following :

- DEA astrophysics, data statistical analysis
- DEA computing
- DEA mechanics and engineering
- DEA photonics, images and cybernetics
- DEA physics of condensed matter and materials
- DEA subatomic physics

A certain number of courses are common to both educational programmes.
The choice of subject for the end of course project is made together with the director of the option at the school and the director of the DEA course to help the student in his third year practical placement to tackle both aspects of research and industry.

The third year in another school (in France or Abroad)

All students who obtain an average mark of at least 12 out of 20 during their first two years have the possibility to carry out their third year in another establishment. To be able to do this the student must present a highly motivated application before a commission. The commission consists of the director of studies, a language teacher (if the choice for this third year is a school abroad), and the specialist teachers in the field in which the student wants to continue their studies.
Each student who is allowed to continue their education in another establishment is allocated a tutor.
Depending on their final results, the jury of the third year of ENSPS reach a verdict on the validation of the engineering diploma of ENSPS.

The PhD – a tradition at the ENSPS

The introduction of our students to the world of scientific research is a strong tradition at the ENSPS. Unlike many other schools the ENSPS has had, since its foundation, strong links with the University Louis Pasteur and its research laboratories. This is reflected in its educational programmes that are designed to train engineers, particularly for the field of " Research and Development" (R & D) .
This introduction to research can already begin in the first year with the student undertaking their training period in a laboratory. The courses in the first two years give a solid scientific culture leading to the preparation of a pre- PhD post-graduate Diploma (DEA).
About 60% of students take and pass their DEA at the same time as qualifying for their engineering diploma. The DEA can also be considered as a complement to a specialised professional education, preparing students for careers in research and development in high-tech companies. Most of the DEA courses mentioned above form part of the SPI (Science for the Engineer) doctorate school of the University Louis Pasteur which trains future doctors in the SPI field.
Students who take a DEA course together with an option in the third year are consequently able to prepare a thesis. In fact the DEA constitutes the first year of a PhD course and allows the student to prepare a thesis which usually takes three years.

➢ The motivation for studying for a doctorate

A third of the students receiving their diplomas from the ENSPS continue to study for a doctorate. The preparation for a PhD is at the same time an education in research and a first professional experience. It allows the student to acquire a rigorous method of working and a high level of competence in the specialised field of their doctorate.

The doctorate is prepared in either a public research laboratory or an industrial research and development laboratory. Preparation for a PhD is necessary for access to :

- The important public research organisations such as the CNRS, INRIA, LCPC, CEA, CNES etc.
- Higher education, senior lecturer (teaching and research) at a university or higher education establishment.
- Positions of responsibility in the research and development sector in industry.

Finally career possibilities for doctor of engineering show that a PhD is an asset for international mobility or in application for positions in international organisations and often an indispensable prerequisite.

➢ Financial conditions

A range of types of financial assistance are offered for preparing a PhD

- A research allowance from the Ministry of Research and Training
- Doctor of Engineering grants from the CNRS
- Grants from important public research organisations such as: CNES, INRIA, CEA, LCPC, ONERA etc.
- CIFRE grants that are co-financed by the Ministry –and the private sector
- Regional research grants financed or co-financed by the Region of Alsace
- A salary paid by a laboratory from its contractual resources
- A salary paid by a company

About 60% to 70% of thesis carried out through the diplomas at the school are financed by ministerial allowances.

International relationships

➢ An objective of priority

One of the main objectives of the ENSPS is to further develop from the beginning of the engineering course international relationships. The school therefore actively encourages the students during their studies to carry out at least one of their three compulsory practical placements abroad.
Furthermore, lecturers and researchers from the school, who are very involved in the on-site research laboratories are in regular contact with their homologues abroad and strongly encourage international exchange.
To reach a level where students are able to work or study abroad the school demands that they study two foreign languages, of which English is compulsory. It has also established a number of important agreements with universities abroad with the support of the University Louis Pasteur.
At the same time it has a very large number of contacts with international industries covering the range of specialities at the school.

The periods set apart for these stays abroad are :

- the training period at the end of the first year of one to two months
- the training period at the end of the second year of two to three months
- the end of the degree course project which lasts for a minimum of twenty weeks

The school also offers the possibility to some students of taking the whole of their final year at one of the partner foreign universities with the agreement of the director of studies of the programme being followed abroad.

➢ Financial conditions

A variety of means of financing a stay abroad are proposed to help with some of the costs incurred.

- Grants for European programmes of SOCRATES and LEONARDO
- Grants from local government Alsace Regional Council, the Bas-Rhin General Council, and the City of Strasbourg
- Financial aid given by the laboratory
- Salary paid by the company abroad

In the past few years 60-70% of students from the school have been abroad at least once during their studies to carry out a training period, for the end of their degree course project or their third year.

➢ A post-graduate European degree course

Finally, ENSPS students, after receiving their diplomas, can also enrol for a specialised European Masters. For example the ENSPS has been selected by the Higher Education Authority to provide a Masters course in "Image Vision and its applications", a European diploma in co-ordination with the Mining School of Nancy.

- Entry requirements: an engineering diploma or a five-year post 'A' level education
- Length of studies: 12 months
- Aim : a specialisation for engineering graduates to master the workings and management of multidisciplinary, international R & D projects for computer imagery and its applications for metrology, vision control, medical imagery, remote sensing with a complementary approach in synthesis and image processing.

The future post-graduates will be in a position to act as head of a project in international industries. They will be particularly prepared to be in charge of multidisciplinary and multicultural R and D teams.

Integration into the world of work

At the end of their schooling our students will have become engineers who set out to look for their first job. Like all our graduates they are subject to the economic situation and to competition. As far as the latter is concerned our school has certain advantages over other sorts of education :

- The "general" character of the diploma
- The openings through the education to research
- The international side of our establishment
- The diversity of the third year options

The rapid advances in technology or variations in the market place sometimes force industrialists to reorganise their production. This happened, for example, in the world of the mobile phone which has recently passed through a phase of upheaval. It is important, therefore, to provide the engineers with a solid general foundation upon which, if need be, they would be able to retrain easily. This is our philosophy for the first two years of the engineering course so that the students acquire a knowledge of physics, computing and engineering science which is sufficiently broad to allow them to adapt, if needed, to meet the demand. Moreover, taking into account the general aspect of this course our engineers are more easily able to continue their education with a post-graduate diploma.

The second point to underline is the opening into the world of research that we offer our students and the possibility they have in the third year of preparing for a DEA or pre-PhD studies that will lead on to a PhD. This immersion into the world of research is made easier by having both the school's laboratories and those of the nationally and internationally renowned CNRS on site. As we have already pointed out (see "doctorate studies – a tradition at ENSPS") the thesis for our engineers is of an international character.

This brings us to another strong point in our education, its international nature. The geographical situation of our school directs the students quite naturally into a European culture.

A number of our students find work internationally, not only in Germany, but also in Europe, the USA, Japan or Canada. The international fame of the University Louis Pasteur also contributes to a great extend for our school with its numerous exchange programmes with students from other institutions.

Finally, we would like to underline the importance of the diversity and originality of the options offered. Our good students, having acquired a solid foundation of quality in the first two years can choose an option that will lead them straight to their professional career.

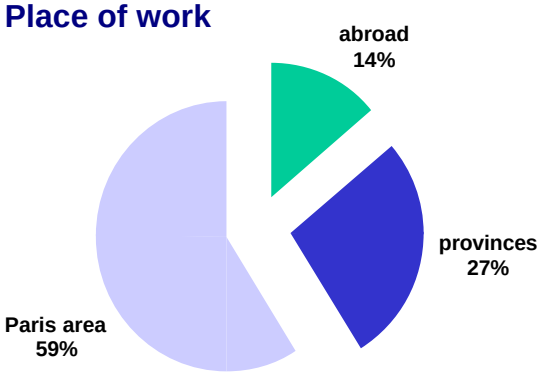
The first employment

Like all schools, the ENSPS receives employment offers from all sectors related to its education. Half the students continue with a complementary education while the other half are integrated into the world of work. The distribution is as follows:

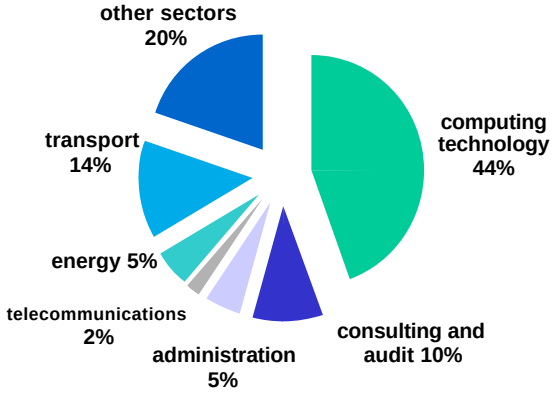
- 30% of graduate students chose to prepare for a PhD
- 20% continue their education by taking a complementary diploma such as commerce or management
- 20% of students find an employment before they have completed their studies by being offered an employment at the company in which they carried out their end of course project
- the final 30% apply for jobs and find their first employment within an average of two months (period noted at the end of 2001)

The average annual gross salary for students finishing school in 2001 employed in companies was 30 000 euros in France and 40 000 euros abroad

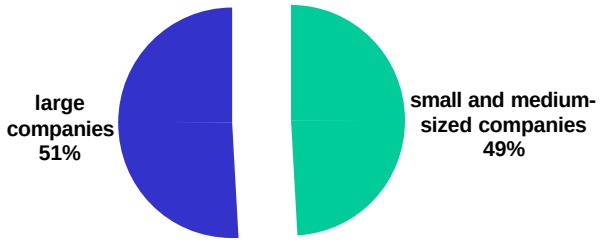
↓ Place of work



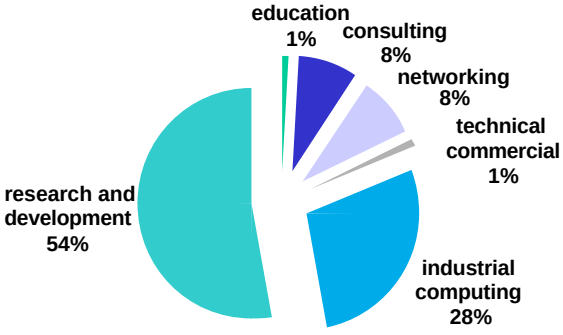
↓ Types of employment



↓ Types of companies



↓ Industrial sectors



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