

# POST GRADUATE MASTER COURSE

# Space Exploration and Development Systems

**IV Edition 2008/2009**



sistema  
qualità  
certificato



The II Level International Post Graduate Master Course in “**Space Exploration and Development Systems**” (4<sup>th</sup> edition 2008-2009) established by Politecnico di Torino (Italy), ISAE/Supaero Toulouse (France) and managed in Torino by COREP.

COREP – Consortium for the Research and Permanent Education – is a no-profit consortium created in 1987 on the initiative of the three Piedmont Universities – Polytechnic of Turin, University of Eastern Piedmont “A. Avogadro” – local bodies and important Italian industries and associations. One of the main goals of COREP is to provide high qualifying training services to young graduates in order to facilitate their entrance in the labour market, promoting the cooperation between universities and socio-economic actors. Since 1999 COREP is certificated UNI EN ISO 9001:2000 for the design and delivery of education and training activities.

**The Master is sponsored by:**

ESA - European Space Agency  
Thales Alenia Space Italia  
ASTRIUM Space Transportation, Bremen  
ASTRIUM Toulouse  
OHB System AG, Bremen  
ALTEC Torino  
Comitato Promotore Distretto Aerospaziale Piemonte  
Thales Alenia Space France  
ASI – Agenzia Spaziale Italiana  
DLR – Deutsches Zentrum für Luft- und Raumfahrt  
CNES - Centre National d’Etudes Spatiales  
ZARM, Bremen

**With the support of:**



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Prof. Gianfranco Chiocchia, Department of Aerospace Engineering, Politecnico di Torino

**Educational Project Manager:**

Prof. Ernesto Vallerani, Former President of Thales Alenia Space and Former Vice Chairman of the International Academy of Astronautics (IAA)

**Chief Project Work Tutor:**

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## **1. WHY THIS MASTER?**

Thanks to its innovative programme, SEEDS aims to meet the request emerging from the European Space Industry of a new generation of high level specialists, whose main characteristics are to be educated in an international environment and to have gathered an experience in working on advanced projects in some of the most renowned Space Centres, Agencies and Companies of the European Union. To fulfil these objectives, SEEDS originates from the collaboration of three European universities, namely an Italian (Politecnico di Torino), a German and a French one (Supaero Toulouse, now ISAE), all located in towns whose common feature is that of hosting industries and research centres linked to one another by a long-standing tradition of co-operation in space.

The main object of SEEDS is the exploration of the space and the development of the related systems. It deliberately differs from the utilization of the space, which forms the object of other existing master courses (most of them on national bases). Selecting the **space exploration** as its principal theme, SEEDS aims to harness the most recent development lines emerging in the space strategies of both the European Union and the USA and, according to these strategies, to prepare the specialists who will be required in the near future.

## **2. JOB OPPORTUNITIES**

Being focused on the Engineering of the Space Systems for Exploration and Development, the SEEDS Master Course is perfectly phased with the National, European and International projects on Exploration such as the ESA Aurora Programme and the NASA Constellation Programme (see [www.esa.int](http://www.esa.int) and [www.nasa.gov](http://www.nasa.gov)).

SEEDS looks at the major European Space Agencies and Companies involved in Exploration projects, such as the European Space Agency (ESA), the Italian, German and French Space Agencies (ASI, DLR and CNES), the ASTRIUM, Thales Alenia Space, OHB Systems Companies/the EADS, Thales Alenia Space, OHB Companies and other establishments. These organizations are strongly interested to the Master initiative because its main focus is on the training of engineering resources oriented to the specific Exploration system products, prepared to work in an international context and trained on the job by using modern and company oriented engineering methodologies.

It is expected that the students successfully completing the SEEDS courses and associated Project Works will be employed by the partner organizations at the proper level in their Engineering Teams working on the Space Exploration projects. The employment rates of the graduates from the two first SEEDS editions (the only ones concluded at present, the third being still running) confirm these expectations: 13 graduates (out of 15) from the 2005/06 edition and all the 11 graduates from the 2006/07 edition are presently working on space activities.

## **3. ADMISSION REQUIREMENTS**

A Bac+5 level degree (e.g. French Diplôme d'Ingénieur, Italian Laurea Magistrale or former 5-year Laurea, German Diplom or equivalent degree at MSc level) in Industrial Engineering (Aerospace, Mechanical, Thermal, Nuclear, Electronics ...), in Information and Communications Technologies or in Physical Sciences is required.

It is required to the participants a good knowledge of English.

## **4. MASTER LOCATION**

The first 6 months of lectures and exercises in Torino will be held at COREP, C.so Trento 13.

The Introduction to the SEEDS Project Work activity will be performed in Torino at the Space Centre ESTEC. In the first three editions of SEEDS the Project Work phases have been sequentially performed in Toulouse (CNES, EADS Astrium ...), Bremen (EADS ST, OHB Systems...) and Torino (Thales Alenia Space, ALTEC ...) under the supervision of senior experts from the local Space Industry and of the general Project Work co-ordinator and included extensive stage periods. The reported sequence may be modified each year according to the educational and organizational needs and to the availability of the local partners. It is expected that – as in the first three editions – the final Project Work discussion will be held at the ESA ESTEC Space Centre in Noordwijk, Olanda.

Information on the Partner Universities can be found in the European SEEDS Web site: [www.seeds-master.eu](http://www.seeds-master.eu)

## **5. PROGRAMME**

The courses working language will be English.

Since the University of Bremen and Toulouse did not activate the SEEDS Master Course in their site, the new training programme has slightly been modified and actually result in 14-15 months for a total amount of **1750 hours and 90 credits**.

It will start in **November 2008** and will finish in **December 2009**.

The course attendance is mandatory and implies full time engagement **from Monday to Friday** (9.00-13.00; 14.00-18.00). The average class workload is almost 36 hours/week.

The **first 6 months** (about 704hours) will be spent either at Politecnico di Torino (SEEDS programme) or at ISAE-Supaero (TAS-Astro programme) and will mainly consist of **class lectures and exercises** providing the general foundations of the various disciplines related to Space Exploration. Visits to National or European facilities as well as conferences and lectures of distinguished personalities are foreseen throughout this phase. The planned average class attendance is almost 32 hours/week.

Learning assessments on all subjects are foreseen in each SEEDS site at the end of any lecture phase, possibly grouped to homogeneous clusters to be evaluated as a whole.

In the following **9 months** (about 1000 hours) the students approach the future **Project Work Activities**. Then they extensively **develop the SEEDS Project Work** under the guide of experienced senior tutors. Thanks to its extension this Project Work is one of the main characteristic features of SEEDS. It is divided into three phases, each one dedicated to a special aspect of the space exploration. A specific theme is identified every year (e.g. the preliminary design of a lunar outpost and that of a lunar permanent basis have been the themes of the first two SEEDS editions). The Project Work is divided into three phases, each one lasting about two months and dedicated to a specific aspect of the selected theme, taking also into account the locally available dominating competences. The three phases are hosted in a temporal sequence by universities, industries and centres of the associated European towns. During the whole Project Work students are grouped together and work in cross-national teams. The Project Work itself is an advanced and ambitious activity, intended to lead to scientific reports to be diffused worldwide in the space community.

The activities performed during the 2006 and 2007 Project Works are described in Executive Summary 2006 and Executive Summary 2007 respectively.

The SEEDS structure displays only slight differences among the teaching activities in associated sites. Subjects studied in Torino are:

### **Understanding Space: Introduction to Space Basic Concepts**

Space and planetary environment; Orbits and astrodynamics; Entry, descent, landing and ascent; Mission analysis; Space human engineering - Crew safety; Space utilization; Space system engineering I; Space programme management; Product and quality assurance; Planetary aerothermodynamics.

### **Learning about Space Systems: Fundamentals of Space Engineering**

Space System engineering II; Space robotics; Space propulsion; Attitude determination, guidance and control; Environmental control - Life support; Thermal control; Space telecommunication; Power generation; Space materials and structures; Space avionics; Costs estimation; Launchers.

## **6. SCIENTIFIC COMMITTEE**

The Scientific Committee is made up of:

Prof. Gianfranco Chicocchia, Director - *I Facoltà di Ingegneria, Dip.di Ingegneria Aeronautica e Spaziale, Politecnico di Torino*

Prof. Ernesto Vallerani, Educational Project Manager - *Former President of Thales Alenia Space and former Vice Chairman of the International Academy of Astronautics (IAA)*

Ing. Enrico Beruto, Chief Project Work Tutor - *Former System Engineer Manager, Thales Alenia Space*

Prof. Maurizio Pandolfi - *I Facoltà di Ingegneria, Dip.di Ingegneria Aeronautica e Spaziale, Politecnico di Torino*

Prof. Sergio Chiesa - *I Facoltà di Ingegneria, Dip.di Ingegneria Aeronautica e Spaziale, Politecnico di Torino*  
Prof. Marco Di Sciuva - *I Facoltà di Ingegneria, Dip.di Ingegneria Aeronautica e Spaziale, Politecnico di Torino*  
Ing. Piero Messidoro – *Thales Alenia Space*

## **7. HOW TO APPLY**

In order to apply for a Master or a specializing Course please fill in the Subscription Form (download: **.doc** or **.pdf** at <http://www.seeds.formazione.corep.it/seeds08/application.html>) and send it by the deadline in one of the following way:

- by electronic mail (**iscrizioni@corep.it**)
- by fax (+39 011 0905110)
- hand delivered to Master Corep Secretariat (Corso Trento, 13 – 10129 Turin, ITALY)
- by ordinary mail. Please send a closed envelope to: Segreteria Master Corep (Corso Trento, 13 – 10129 Turin, ITALY)

### **NEW DEADLINE: 14<sup>th</sup> NOVEMBER 2008**

The application is unbinding. It only aims to be admitted to the selection.

Following documentation (the list of documents is also provided in Italian at the **note 1**) must be provided in attachment:

- **ALL STUDENTS** must also enclose:
  - the Subscription Form (download: **.doc** or **.pdf**)
  - Copy of the MSc (or MSc equivalent) degree together with the transcript of records of the sustained examinations
  - Curriculum Vitae according to the European standard (Europass CV in **.doc** or **.pdf** format). It must include the authorization to the treatment of the personal data (Italian DL 196/2003). In any case **the curriculum must be sent in electronic format to iscrizioni@corep.it**.
  - 1 passport photo with name and surname reported on the back (if the application has been sent by email, the photo is not mandatory, but has to be provided in case of admission.)
  - Copy of a passport or identity card valid
  - Copy of “Codice Fiscale” (Italian individual tax code) It is obtainable at the “**Agenzia delle Entrate**” local office (Italian Internal Revenue Service) by presenting a document of identification (foreigners must present Passport or Permit of Stay). Residents abroad can refer also to Italian Consulates.
  - For further information (<http://www.agenziaentrate.it/ilwcm/connect/Nsi/Servizi/Codice+fiscale++Tessera+Sanitaria/Codice+fiscale+faq/>)
  - Title of the MSc (or MSc equivalent) final project together with a short summary of its contents (max one page)
  - Self certification Module (in **.doc** or **.pdf** format).
  - Form: “Main Professional Condition” (in **.doc** or **.pdf** format).
- **STUDENTS WITH ITALIAN DEGREE** must also enclose:
  - Degree thesis with all exams. For final year student it is sufficient a certificate of exams with marks. It's also accepted the self declaration ex art. 445/2000, articles 46-47 (**.doc.** or **.pdf**).
- **STUDENTS WITH FOREIGN DEGREE** must also enclose:
  - declaration of value and certificate with the translation of all the passed exams. This declaration must be requested to the Italian Consulate in the country where the student had the degree. Community citizens may submit certified copies of the titles about the Declaration of Value. Extra-community citizens have to submit originals of the titles about the Declaration of Value.
- **FOREIGN STUDENTS FROM COUNTRIES INDICATED IN THE VISA SYSTEM AND THE ENTRY OF ALIENS INTO ITALY AND THE SCHENGEN AREA (www.esteri.it/visti/home.asp) LIVING IN ITALY** must also enclose:
  - Entry Visa and residence permit

- **FOREIGN STUDENTS FROM COUNTRIES INDICATED IN THE VISA SYSTEM AND THE ENTRY OF ALIENS INTO ITALY AND THE SCHENGEN AREA ([www.esteri.it/visti/home.asp](http://www.esteri.it/visti/home.asp)) NOT LIVING IN ITALY** must also enclose:
  - a motivational letter if, according with the Selection Commission, the interview will not be in presence;

**Incompletes application forms won't be considered as valid.**

The COREP Secretariat Office will send an acknowledge of receipt (by phone or by e-mail) of the application in 3 working days. If you don't receive any communications, please contact our Office by phone or e-mail.

**For more info please call the Info-Point: Tel +39 011 0905107. E-mail: [formazione@corep.it](mailto:formazione@corep.it)**

Note <sup>1</sup>

- Domanda di Iscrizione (in formato .doc o .pdf)
- Certificato di laurea con esami; per laureandi certificato degli esami con voti. È ammessa anche l'autocertificazione (in formato .doc o .pdf);
- Curriculum vitae secondo lo standard europeo (Europass CV in formato .doc o .pdf). Il curriculum dovrà riportare in calce l'autorizzazione al trattamento dei dati personali (D.Lgs.196/2003);
- 1 fotografia formato tessera con indicati nome e cognome sul retro (se la domanda viene spedita in formato elettronico, la fotografia non è obbligatoria, ma deve essere consegnata in caso di selezione);
- Copia di un documento di identità in corso di validità (Carta di Identità o Passaporto)
- Copia del Codice Fiscale  
Richiedibile presentandosi all'Ufficio locale dell'Agenzia delle Entrate con un documento di riconoscimento (gli stranieri devono presentare passaporto o permesso di soggiorno).
- I residenti all'estero possono rivolgersi anche ai Consolati, se collegati al sistema informativo dell'Anagrafe Tributaria.  
Per maggiori informazioni (<http://www.agenziaentrate.it/ilwwcm/connect/Nsi/Servizi/Codice+fiscale++Tessera+Sanitaria/Codice+fiscale/>)
- Titolo della tesi accompagnato da una breve sintesi (massimo una pagina) della medesima;
- Modulo "Condizione Professionale Prevalente"(in formato .doc o .pdf).

## **CONFIRMATION OF REGISTRATION**

At the end of the selection a definitive classification list of the eligible candidates will be written. These candidates will receive, subject to available places, the proposal to be registered to the Master. The student will regularize the registration through the apposite form("Confirmation of registration").

It is correct to specify that:

- **STUDENTS WITH ITALIAN DEGREE** will have to deliver copy of the original of the Thesis Degree.
- **FOREIGN STUDENTS FROM COUNTRIES INDICATED IN THE VISA SYSTEM AND THE ENTRY INTO ITALY OF ALIENS AND THE SCHENGEN AREA ([www.esteri.it/visti/home.asp](http://www.esteri.it/visti/home.asp))** before to regularize the registration about the form ("Confirmation of registration"), must give to the Secretary, within expiration date, the Visa of entrance for study reason type D with multiple entrances and the residence permit.

Further information about documents for foreign students are available on the site: [www.esteri.it/visti/home.asp](http://www.esteri.it/visti/home.asp)

Personal data will be used by COREP according to Italian laws (Article n. 13 Legislative decree n. 196/03).

## **8. SELECTION OF APPLICANTS**

The selection is based on the curricula of the applicants and oral interviews.

A Selection's Board, made up of the Director, the COREP Organisational Coordinator and some representatives of the Academia or the Space Industry, will examine all submitted application forms and curricula and reject those not complying to the general requests to be enrolled in the SEEDS Master Course. The selected applicants will then be admitted to an oral interview in English. At the end of the selection process a list of the successful applicants will be produced. These will be enrolled in the SEEDS Master Course according to the position in the list and to the number of available places.



During this interview, knowledge about Informatics (Internet, E-mail, Windows, Word and Excel), if not certified by given exams, will be tested.

A maximum number of 15 participants is foreseen in Torino.

N. 6 places will be reserved to foreign candidates and/or applicants from outside Piedmont.

## **9. TUITION FEE**

The Postgraduate Master Course has been approved and funded by the European Social Fund (Bando Regionale per Master Universitari di I e II livello 2008/2009 – D.D. n. 345 del 04/08/2008).

**Thanks to new sponsorships the tuition fee is 3.000,00 Euro.**

This rate is intended for the whole SEEDS course and includes also the university fees.

The Master will take place if the minimum number of 10 participants is reached. The Scientific Committee may decide to activate the Post Graduate Master Course with a reduced participant's number.

Accommodation and travel costs during the all teaching and Project Work phases are to be sustained by the students.

All Italian students enrolled in Post-graduated Master Courses managed by COREP can get an "**ad honorem loan**" for an amount of **5.000 Euro** per year given by UniCredit Bank. To get the loan it is sufficient to present an Enrolment Certification to the Master, without other requirements. Further information can be asked to the COREP Master Secretariat.

## **10. ATTENDANCE, EVALUATION AND DEGREE AWARDING**

A Master Thesis followed by a discussion concludes the course and finally leads to the award of the Master Degree by Politecnico di Torino. Additionally, a - jointly released - common SEEDS Certificate/label will be attached to the National Degrees.

In order to get the Master Degree the participants have to attend at least the 2/3 of the lectures hours (certificated by signature), to pass all foreseen examinations and to successfully conclude the Project Work and Thesis activities.

To be entitled to obtain the University Master Degree, the Italian students must comply to the Italian requirements stated by the law on education T.U. of 1933 art. 142 (simultaneous enrolment in other universities courses, doctorates, etc...is not admitted).

## **11. COURSE ORGANIZATION**

### **Understanding Space: Introduction to Space Basic Concepts - Space and Planetary Environment**

*Teacher:* Ing. LOBASCIO (Thales Alenia Space)

*Number of lecture's hours:* 24

*Number of Credits:* 2

*Contents:* Understanding the space environment. Difference with respect to the terrestrial environment. Effects of cosmic radiations. Effects of the vacuum. The gravity. Boundaries of the terrestrial atmosphere. The planetary atmospheres. Impact of micrometeorites and space debris.

### **Understanding Space: Introduction to Space Basic Concepts – Orbit and Astrodynamics. Entry, Descent, Landing, Ascent**

*Teacher:* Prof. AVANZINI (Polito)

*Number of lecture's hours:* 48

*Number of Credits:* 4

*Contents:* Basic concepts of orbital motions. Laws of Newton. The two-body problem. Orbital perturbations. Manoeuvres in space. Transfer of orbit. Rendez-vous. Interplanetary flight. Fly-by effect. The four-body problem, solutions by superposition.

### **Understanding Space: Introduction to Space Basic Concepts - Mission Analysis**

*Teacher:* Ing. Piras (Thales Alenia Space)

*Number of lecture's hours:* 36

*Number of Credits:* 3

*Contents:* Basic concepts of orbital motions. Laws of Newton. The two-body problem. Orbital perturbations. Manoeuvres in space. Transfer of orbit. Rendez-vous. Interplanetary flight. Fly-by effect. The four-body problem, solutions by superposition.

### **Understanding Space: Introduction to Space Basic Concepts - Space Human Engineering. Crew Safety**

*Teacher:* Prof. QUAGLIOTTI Fulvia (Polito); Ing. GAIA (Thales Alenia Space)

*Number of lecture's hours:* 36

*Number of Credits:* 3

*Contents:* Environmental effects on human beings. Difference between manned systems and satellites. The extra-vehicular activity. Architecture of the manned systems. Space stations. The lunar base. Human settlements on Mars. The space colonization: basic requisites.

### **Understanding Space: Introduction to Space Basic Concepts – Space Utilization**

*Teacher:* Prof. Vallerani

*Number of lecture's hours:* 36

*Number of Credits:* 3

*Contents:* The disciplines of Space Physics: astronomy, planetology, the solar system, plasma physics, microgravity. The disciplines of Life Sciences: space biology, the man in space. The applications: telecommunications, space navigation, observation of Earth.

Understanding Space: Introduction to Space Basic Concepts - **Space Programme Management - Costs Estimation**

*Teacher:* Ing. Messidoro (Thales Alenia Space)

*Number of lecture's hours:* 18

*Number of Credits:* 2,5

*Contents:* Phases of development of a programme. The business plan. Cost analysis. Project monitoring. Integrating the system of the co-producers. The responsibility of the Prime Contractor.

Understanding Space: Introduction to Space Basic Concepts - **Product Quality Assurance**

*Teacher:* different teachers

*Number of lecture's hours:* 12

*Number of Credits:* 1

*Contents:* Project risk assessment. Procedures to analyse the failure modes. The assurance of quality. The system of the on-ground testing and proofing.

Learning about Space Systems: Fundamentals of Space Engineering - **Space System Engineering I - II**

*Teacher:* Prof. CHIESA (Polito) and Ing. FERRO (Thales Alenia Space)

*Number of lecture's hours:* 88

*Number of Credits:* 6

*Contents:* The concept of system. Subsystems and components. The system of systems. System integration. Functional analysis. The phases of a project: conception, development, testing, qualification, operations in orbit. Integrated project, use of CAD. Concurrent Engineering processes. Parametric analyses. Optimization methods.

Learning about Space Systems: Fundamentals of Space Engineering – **Space Telecommunications**

*Teacher:* Prof.ssa VISINTIN (Polito)

*Number of lecture's hours:* 48

*Number of Credits:* 3

*Contents:* The architecture of the communication system: the Earth stations, the centre of control, the satellite, the connecting satellites. Principles of radio-communications. Collecting and processing data. The satellite computers. The communications among the components of the infrastructural system on a planet. Permanent bases and moving vehicles.

Learning about Space Systems: Fundamentals of Space Engineering - **Space Propulsion - Launchers**

*Teacher:* Prof. CASALINO (Polito)

*Number of lecture's hours:* 36

*Number of Credits:* 3

*Contents:* Principles of space propulsion. Chemical, electrical and nuclear engines. Types of propulsive systems: solid vs. liquid, mono vs. bipropellant. Hybrid engines. Comparison of performances. Optimization of the propulsive system in the ground base and during the mission.

Learning about Space Systems: Fundamentals of Space Engineering – Planetary Aerothermodynamics

*Teacher:* Prof. D'AMBROSIO (Polito)  
*Number of lecture's hours:* 36  
*Number of Credits:* 3

*Contents:* The re-entry problem. The various atmospheres and the different trajectories. The flight regimes during re-entry. The physical phenomena during the re-entry. Non-reacting compressible flows: the boundary layer, the shock waves. Compressible flows with chemical reactions. Heat transfer into the body wall. Numerical simulations and wind tunnel tests.

Learning about Space Systems: Fundamentals of Space Engineering - Environmental Control and Life Support

*Teacher:* Ing. LOBASCIO (Thales Alenia Space)  
*Number of lecture's hours:* 36  
*Number of Credits:* 3

*Contents:* Requisites for an environmental control system capable to assure the human presence in space. Management of the available resources. Environmental control: dispersion and processing of waste. Designing closed - cycle systems.

Learning about Space Systems: Fundamentals of Space Engineering – Space Structures and Materials

*Teacher:* Prof. DI SCIUVA (Polito)  
*Number of lecture's hours:* 36  
*Number of Credits:* 3

*Contents:* Requisites for structures hosting astronauts. Design loads in the various phases of the operating life. Types of structures. Material properties. Dimensioning a pressurized module of a space station. Fracture mechanics. Impact with micrometeorites. Ground testing. Certification and flight qualification.

Learning about Space Systems: Fundamentals of Space Engineering - Thermal Control

*Teacher:* Ing. SACCHI (Thales Alenia Space)  
*Number of lecture's hours:* 36  
*Number of Credits:* 3

*Contents:* Fundamentals of the thermal control of a space vehicle. Design of the control system. Thermal shields. Passive and active thermal control. Components of a thermal control system. Thermo-mechanical characteristics of the materials. Principles of ablative protection. Thermo – structural optimization. Experimental tests and numerical simulations.

Learning about Space Systems: Fundamentals of Space Engineering - Space Robotics

*Teacher:* Prof. GENTA (Polito)  
*Number of lecture's hours:* 36  
*Number of Credits:* 3

*Contents:* Base concepts of robotics. Man – robot comparison. Base requisites and employment modes. Principal elements of a design. Remote control. Optimization of a robotic system. Applications to a Moon – Mars mission.

**Learning about Space Systems: Fundamentals of Space Engineering – Power Generation**

*Teacher:* Ing. BOARETTO (Thales Alenia Space)

*Number of lecture's hours:* 18

*Number of Credits:* 1,5

*Contents:* The generation on necessary power to be operation of a space vehicle.

**Learning about Space Systems: Fundamentals of Space Engineering – Attitude Determination, Guidance and Control - Space Avionics**

*Teacher:* Ing. Santangelo (ALTEN)

*Number of lecture's hours:* 18

*Number of Credits:* 3

*Contents:* The control of Space vehicle on the Moon and Mars surface.

**Equal Opportunities**

*Teacher:* to be confirmed

*Number of lecture's hours:* 22

*Number of Credits:* 2

*Contents:* Culture and equal opportunities between man and woman. Equal opportunities legislation.

**Project Work Activity – Plenary Session to start Project Work Activity**

*Teacher:* Different experts

*Number of lecture's hours:* 80

*Number of Credits:* 4

*Contents:* Illustration of the Project Work concept. Planning the sequential phases. Becoming familiar with the “Concurrent Engineering” methods. Definitions of the working teams.

**Project Work (Fixed Segment)- Plenary PWA Activities and Conclusive Plenary Session in Torino**

*Teacher:*Tutors in Torino

*Number of lecture's hours:* 320

*Number of Credits:* 10

**Project Work (Transportation Segment) - Plenary PWA Activities and Conclusive Plenary Session in Bremen**

*Teacher:*Tutors in Bremen

*Number of lecture's hours:* 320

*Number of Credits:* 10

**Project Work (In-Space segment) - Plenary PWA Activities and Conclusive Plenary Session in Toulouse**

*Teacher:* Tutors in Toulouse

*Number of lecture's hours:* 320

*Number of Credits:* 10