Master Course in Space and Astronautical Engineering
AEROSPACE ENGINEERING PROGRAMME 2017-18
Welcome to Aerospace Engineering at Sapienza Università di Roma

The long tradition of Sapienza University in the field of Aerospace Education dates back to 1926, with the establishment of the School of Aeronautical Engineering, which provided postgraduate training to a selected group of engineers. The fast growth of the aerospace industry and of the research activity in the sector prompted the need for a more complete and balanced teaching offer. On 1963, the postgraduate education was entrusted to the School of Aerospace Engineering. On 1980, the Faculty of Engineering established a five-year course in Aeronautical Engineering aimed at a wider range of students. On 1990, a five-year course was established in Aerospace Engineering, which also included a curriculum in Space Engineering. On 2012, the Aerospace Education at Sapienza was reorganised in one three-year Bachelor Degree in Aerospace Engineering and two Master of Science Degrees (Aeronautical Engineering, Space and Astronautical Engineering).

After the Master of Science Degree, the training in Aerospace can be continued at Sapienza by joining one of three one-year Professional Master Courses in Civil Aviation, in Satellites and Orbiting Platforms, or in Space Transportation Systems. Finally, the educational offer is completed with a three-year Ph.D. Course in Aeronautical and Space Engineering. Our objective is to offer high quality teaching in aerospace engineering with the goal of developing student knowledge and skills in formulating, analysing, and solving new and challenging problems. We offer study pathways that attract talented young people who are strongly motivated and interested in aerospace engineering, and eager to take positions of responsibility in industry, academia, or state entities and institutions. We also promote internationalisation of the study pathways by favouring the mobility of students within the European university systems, in the most effective way.

We favour a collaborative and interdisciplinary approach on aerospace disciplines that stimulates the creativity of students with a firm background in the basic academic disciplines. Aerospace Engineering offers a complete overview of the prospects and opportunities in the job market, and promotes the creation of study pathways geared up with the expectations of the industrial world where academic knowledge is complemented by the specific skills that industry seeks.

Prof. Guido De Matteis
Chair of the Academic Council of Aerospace Engineering

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SPACE AND ASTRONAUTICAL ENGINEERING IN ROME

The Space and Astronautical Engineering Masters Programme (SAEM) provides students with specific skills related to Space mission planning and the analysis and design of launch vehicles, satellites and remote metering and telemetry systems. The programme emphasises system-related and interdisciplinary aspects and is closely linked with research and innovation activities in the Italian and European aerospace industries.

The programme in Aerospace Engineering, which is part of the SAEM degree programme, is held entirely in English and provides students with advanced concepts, professional training and specific engineering skills, enabling them to address complex issues requiring analysis, development, simulation and optimization in a wide range of aerospace-related topics. The course also provides an appropriate level of expertise in basic Space access technologies, the utilisation of terrestrial orbits, and Space exploration, with particular reference to the systemic and scientific aspects of launch vehicles, interplanetary missions by astronautical vehicles, and manned Space missions.

The student learns to use the most advanced investigative and design tools for innovation in the aerospace industry, e.g. improving the performance of launch systems to reduce the cost of entry into orbit per unit mass of payload, payload mass reduction (for platforms, sensors, and power units) and increasing the efficiency and utilisation of the available on-board power.

In year one, students acquire knowledge related to major areas of Space engineering such as spaceflight mechanics and altitude dynamics, Systems and control theory, compressible fluid dynamics, propulsion, Structures and Space systems; whereas during the second year, students select follow-up courses from a wide range of topics directly related to Space and Aeronautical Engineering.

CAREER OPPORTUNITIES

The career prospects for the Space and astronautics engineer are in the advanced design, planning, programming, and management of complex systems in companies, public bodies, or the profession. The most relevant professional profiles are:
- designer and technical manager
- product and product range manager
- maintenance manager
- specialist in one or more disciplines in the sector: aerodynamics, construction and structures, aerospace equipment and systems, mechanics of flight, propulsion, telecommunications and remote sensing
- certification or quality assurance officer.

As professionals, graduates typically practice in the following areas:
- aerospace industries
- small and medium manufacturers in the aerospace sector supply chain
- national and international public and private research centres
- national and international Space agencies
- consulting firms
- service companies and certification bodies.

Holders of a postgraduate degree in Space and Astronautical Engineering are also qualified to work in related sectors that make use of the advanced scientific and technological content of those disciplines.

HOW TO APPLY

Applicants for the Graduate Degree Course in Aerospace Engineering must already hold a 3-year degree or an Italian or non-Italian qualification recognised as valid under current legislation, and must also meet specific requirements in relation to the curriculum and their personal background. The Admissions Board will verify the applicant’s previous educational attainments, curricular needs, motivations, and other factors for assessment as the applicant may submit, such as periods of study outside Italy, internships, and work experience. The Admissions Board may require the applicant to attend for interview. For admission a B2 English language proficiency certificate or equivalent is required.

The general application procedure is composed of three distinct phases, starting with a pre-enrolment phase in which the best candidates are directly enrolled. Other candidates will be considered for the second and third selection phases. Besides the general documents, the selection process requires the following documents:
- IELTS (International English Language Testing System) or TOEFL (Test of English as a Foreign Language) English Language proficiency certification [certified minimum level B2 or equivalent is required]. The submission of the following documents is strongly recommended and will constitute a positive element in the evaluation for admission to the programme:
  - Cumulative Weighted Grade Point Average (CGPA)
  - GRE (Graduate Record Examinations) General test, or Subject Tests in Mathematics or Physics.

Admission test grades either general or specific for aerospace engineering, as for instance GATE (Graduate Aptitude Test in Engineering) for aerospace engineering (AE), will be also taken into consideration.

Students must apply online at the Sapienza pre-selection application page. Admission procedures are slightly different for foreign students who are EU residents or students who are non-EU residents.

GENERAL REGULATIONS

Teaching methods

Courses are organized into semesters and conventional teaching methods are predominantly adopted. Classes take the form of lectures, classroom exercises, workshop activities, and group work, leaving the student sufficient time for personal study. Nominally the course lasts for 4 semesters spread over 2 years. Students who have already completed the course but have not been awarded the degree, or did not pass all the required examinations for admission to the Final Examination, are enrolled “fuori corso” (“outside the course”).

3
Learning periods must not overlap with

www.ingaero.uniroma1.it (published online at semester or examination session are

- Fifth Examinations Session: November
- Fourth Examinations Session: October
- Third Examinations Session: June
- Second Examinations Session: May
- First Examinations Session: April

Semester 2: late February - May

- Second Examinations Session: February
- First Examinations Session: January

Semester 1: late September -

Normally the programme is as follows:

- Semester 1: late September - December
- First Examinations Session: January
- Second Examinations Session: February
- Semester 2: late February - May
- Third Examinations Session: June
- Fourth Examinations Session: July
- Fifth Examinations Session: September.

The start and end dates of each semester or examination session are published online at www.ingaero.uniroma1.it (Calendar Section).

Learning periods must not overlap with examination periods, except for two special examination sessions that normally take place in October-November and March-April and are reserved for repeating students, students who are “outside the course”, and students who had ceased all attendance before the date of the examination session.

Grading Systems

The Italian university grading system for individual exams is based on a 30-point scale (18 and above is considered passing), while a 110-point grading scale is used for the final dissertation: – 66 is passing), while a 110-point grading scale (18 and above is considered outstanding results.

Teaching calendar

Normally the programme is as follows:

- Semester 1: late September - December
- First Examinations Session: January
- Second Examinations Session: February
- Semester 2: late February - May
- Third Examinations Session: June
- Fourth Examinations Session: July
- Fifth Examinations Session: September.

The start and end dates of each semester or examination session are published online at www.ingaero.uniroma1.it (Calendar Section).

Attendance

Attendance is not mandatory except for the courses of Experimental Aerodynamics and Experimental Testing for Aerospace Structures.

Assessment methods

Normally, the student’s progress in any given subject is assessed by an examination which can consist of oral and/or written tests devised by the tutor. Details of these are provided along with the course programme. For certain activities, instead of an examination there is an assessment of eligibility, also devised by the tutor.

Examination programmes and formats

The examination programmes and formats for each course are published on the CAD website (www.ingaero.uniroma1.it).

Personal Study Plan

The CAD must approve the student’s Personal Study Plan before the optional subjects chosen by them can be included on their List of Examinations. The List of Examinations is cancelled otherwise. The CAD will specifically determine that the subjects chosen are appropriate for the student’s Personal Study Plan.

Students must submit their Personal Study Plan (see the “Percorso Formativo” function of the Infostud service) at the start of Year 1 [indicatively during December - January on specific dates that will be published from time to time on the CAD website].

Only one Personal Study Plan is permitted per academic year. If the student wishes to make changes to their chosen curriculum or examinations, the Personal Study Plan cannot be resubmitted until November of the following year.

Yearly progression

To progress to Year 2, the student must have acquired at least 27 of the credits for Year 1. These credits must have been acquired before January 31 of the calendar year after the academic year in which the student first enrolled. Students who do not meet the requirements for progressing to the next year are enrolled as “repeating students”.

Examinations that can be brought forward

In order to complete the required 60 credits for Year 1, students enrolled on Aerospace Engineering can bring forward one of the subjects for Year 2 or one of their freely chosen optional subjects.

Students repeating Year 1 can apply to bring forward up to 2 of the subjects for Year 2 (respecting the order of the course) whose total worth comes to not more than the value of the credits they already hold.

Credits for examinations brought forward are not considered when calculating the credits required for progressing to the next year.

For details of how to bring subjects forward, see the Students procedure section of the CAD website.

Excellence Pathways

For each curriculum the Aerospace Engineering CAD offers an Excellence Pathway, to further enhance the education of outstanding students who wish to deepen their methodological and practical studies of topics that interest them. The additional learning in the Excellence Pathway enhances the experience of students who have performed particularly well in Year 1. Access to the Excellence Pathway is by application. The requirements are: acquisition of all the credits for Year 1 by 30th November a weighted average mark in any one examination of at least 27.5/30 and not less than 24/30.

Students who take their degree within the time limits for the course and have also successfully completed the Excellence Pathway are awarded a monetary prize for the same amount as the university.
Internships
As an alternative to the final examination, the student can undertake an internship of practical training, which is also worth 23 CFU. At the time of securing approval for an internship the student must nominate two supervising tutors, of whom one must be a university tutor from the relevant CAD, and the other must be active in industry. The academic tutor will relevant CAD, and the other must be a university tutor from the Degree Examining Board. The conditions and methods for applying to take the Excellence Pathway, along with downloadable application form, are given on the CAD website (STUDENTS/Excellence Pathways Section).

Final examination
The final examination consists of an experimental or design thesis, or a written dissertation addressing the subjects taken in the Postgraduate Degree Course, prepared under the guidance of a tutor who is a member of the Academic Council, and/or in collaboration with public and private bodies, manufacturing companies, or research centres that operate in the chosen field of study. For developing the dissertation the students must first review the technical literature on the subject. They are then expected to work on their own initiative in relation to the type of dissertation, and to propose solutions to the problem by developing a suitable mathematical model of the system, as appropriate. The final examination is worth 23 CFU. The final mark is based on the average of all the examination marks, the dissertation, and the final colloquium. The Degree Examining Board awards marks out of a total of 110. Full marks (110/110) with Honours can be awarded by majority vote of the Degree Examining Board.

STUDENTS
Students are expected to acquaint themselves with the regulations governing their university. This information is given on the website www.ingaero.uniroma1.it:
- in the COURSE INFORMATION section of the website: courses on offer (teaching regulations, manifestoes of studies), tutors, course programmes, degree theses, work training, etc.
- in the STUDENTS section: calendars, timetables, study plans, application procedures (transfers/ recognition, changing streams, bringing forward examinations, etc.)
All information published online as set out above constitutes official notification.

THE SYLLABUS
The purpose of the Syllabus is to inform new students about the knowledge, skills and abilities required for embarking successfully on the Aerospace Engineering study pathway, enabling them to check their personal educational background and make any adjustments as appropriate.

Mathematics and numerical methods
Trigonometry: trigonometric functions, Pythagorean theorem, angle transformation formulas, Euler’s formula.
Analytic geometry: Cartesian coordinate systems, equations and curves, distances, angles, intersections of geometric objects. Tangent line and normal to a curve. Changes of coordinates.
Mathematical Analysis: Limits, Continuity, differential calculus; integral calculus; sequences and series; partial and directional derivatives; vector-valued functions; definite, indefinite, and improper integrals; curved line integrals; multiple integrals; surface integrals; differential operators: gradient, divergence, rotational; vector identities; theorems of Gauss, Green, and Stokes, divergence.
Linear algebra: matrix calculation, systems of linear equations; eigenvalues and eigenvectors.
Ordinary differential equations: first order linear and non-linear equations; second order linear equations, Euler equations; initial value problems.
Numerical methods: methods for finding the roots of linear and non-linear algebraic equations, quadrature methods; free optimisation.
Programming elements: any programming language (preferred: Matlab, Fortran, Mathematica).

Chemistry
Atomic structure of matter; periodic properties of the elements; intermolecular and intramolecular chemical bonds; physical and chemical reactions and the energy content associated with them; chemical, ionic, and solubility equilibria; elements of chemical kinetics and electrochemistry; chemical fundamentals of corrosion.

Physical and Analytical Mechanics
Physical quantities, systems of measurement, and scientific method: measure theory, probability elements, errors.
Classical mechanics of particles and rigid bodies: Newton’s laws, cardinal equations and principles of conservation. Macroscopic systems and principles of thermodynamics: temperature, heat, and the first and second laws of thermodynamics.

Materials Science
Main classes of materials, properties, analytical reports selecting/dimensioning/treating materials in relation to the stress conditions and basic operating conditions. Crystalline and amorphous materials; deformability, viscoelasticity, recovery and recrystallisation, binary phase diagrams, Solid state diffusion. Mechanical and physical properties, metallic materials (steels, aluminium alloys, superalloys, notes on titanium and magnesium alloys), correlations between microstructure, properties and processes. Ceramics: mechanical testing and Weibull statistics. Thermal shock. Polymer and composite

Electrotechnics

Applied Mechanics and Design

Mechanics of solids

Aerodynamics
Basic concepts of fluid dynamics: Flow equations in integral and differential form. Irrotational incompressible flows: Kelvin’s and Helmholtz’s theorems, the Bernoulli Equation, elementary and superimposed solutions. Airfoils: profile classification and characteristics, lift generation; finite wings. Viscous flows: laminar boundary layer over a flat plate, boundary layer separation, notes on turbulence and transition.

Compressible flows: compressibility of a fluid, speed of sound. Stationary one-dimensional flows, isentropic flows, normal shock.

Flight Mechanics

Propulsion

Structures
Stress and strain: equilibrium equations, constitutive relations for linear elastic solids, kinematic bond deformation deflection, compatibility equations, state of stress and plane deformation (the Airy function).


COURSE DESCRIPTION
Year 1 of Aerospace Engineering consists of 6 modules worth 54 Academic Credits (CFU) in specific Space Engineering subjects, plus Control Systems.

Year 2 of Aerospace Engineering: the student chooses a course in each of the characterising sectors, from a wide range of topics that also includes specific aeronautical engineering subjects. Additionally, 2 modules in related subjects can be freely chosen by the student for a total of 12 CFU.

2017/18 COURSE DESCRIPTION
First year
AEROSPACE STRUCTURES 1051404
9 CFU
Professor Giuliano COPPOTELLI & Paolo GAUDENZI
Among the main objectives of the course is to define the functions of Space structures in the frame of a Space system (e.g. satellites, launchers); describe the
Objectives of the course is to provide the fundamental theory and physical-mathematical tools necessary for the analysis and design of rockets. To identify the specific requisites and performance parameters of Space propulsion systems. To discuss the main features and application fields of the available options.

Syllabus includes: Fundamentals of aerospace propulsion, Classification, Thrust and specific impulse, Rocket equation, Staging, Ideal rocket theory, Performance parameters, Rocket propulsion, thermochemistry basics; chemical equilibrium, flame temperature; chemical kinetics; nozzle flows (frozen vs. shifting equilibrium). Liquid rocket engines: components, propellants, thrust chamber, injection system, ignition, power cycles, performance, nozzles, thrust vectoring. Solid rocket motors: components, propellants, burning rate, propellant grain configuration, performance, nozzle, thrust vectoring. Hints on other kinds of rockets (hybrid rockets, electrical rockets)

Second year

AEROELASTICITY 1041541
6 CFU
Professor Franco MASTRODDI
The course gives the foundations of the linear theory of the Aeroelasticity (linearly elastic solids in linearized potential flows). Thus, the modeling of the aeroelasticity of fixed wing is comprehensively described and the consequent stability and response (flutter, divergence, gust response, control-surface response, aileron effectiveness and reversal) are faced together with the specific issues due to their numerical implementation.

Programme: Generalized Lagrange Equation for aeroelasticity: spatial and modal representation. i) Bidimensional aeroelasticity. 2-D analytical models for unsteady uncompressible flows (Theodorsen theory), Stability (divergence and flutter) and gust response of a typical section. State-Space representation for aeroelasticity. ii) Three-dimensional aeroelasticity. Unsteady aerodynamic loads on vehicles in linearized uncompressible andcompressible flows.

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Aerospace Materials 1041541
6 CFU
Professor Teodoro VALENTE
The main aim is to allow the students to understand the relationships among innovation, technologies, materials, processes and products in the area of structural materials and materials for propulsion. A multidisciplinary approach of the class of materials and their properties will be adopted in order to evidence and discuss tools available for materials/product selection and design by an engineering point of view.

Aircraft Aerodynamics and Design 1041639
6 CFU
Professor Luca MARINO
The aerodynamic theory is analyzed aimed at the aerodynamic design of a complete aircraft.
Programme: Finite wing theory. Slat and flap devices Jet flap Pressure drag boundary layer theory boundary layer suction wing in the transonic regime aerodynamic and control derivatives Propeller theory.

Artificial Intelligence I 1022771
6 CFU
Professor Daniele NARDI & Luca IOCCHI
The aim of the course is to give the first elements of artificial intelligence. In particular, we present the techniques for knowledge representation and automatically search for solutions and will introduce the language PROLOG. Topics treated are: Artificial Intelligence and Intelligent Agents; Goals of AI; Short History Intelligent Agents, logical agents, learning agents; Logic and Knowledge Representation, Propositional Logic and Reasoning, First Order Logic; Representation problems (survey); Automated Problem Solving; The algorithm A*, Machine Learning, Classification Algorithms Regression Algorithms, Unsupervised Learning Algorithms.

Computational Gasdynamics 1041539
6 CFU
Professor Sergio PIROZZOLI
The main objective of the course is to introduce the student to the modern techniques of numerical analysis applied to gas dynamics. The main focus will be on the definition of general criteria for the development of numerical schemes and on their implementation in numerical codes for the solution of the multidimensional Euler equations.

Digital Control Systems 1041428
6 CFU
Professor Claudia CALIFANO
The course provides methodologies for the analysis of linear and nonlinear discrete time and sampled dynamics, the design of digital controllers with a major focus on linear systems, and implementation on embedded microcontrollers. The student will be able to compute digital models of given discrete time systems as well as digital discrete time equivalent models of continuous dynamics, to design digital control laws both for discrete and for continuous systems and to use standard microcontrollers for their implementation.

Environmental Impact of Aircraft Engines 1041540
6 CFU
Professor Diego LENTINI
The course is intended to identify the causes of chemical and noise emissions from aircraft engines, and the factors which can be exploited to contain them. Chemical emissions are dealt with in the more general frame of man-induced emissions of pollutants and contaminants, and ensuing effects are detailed. Sources of noise emissions are then identified, including non-propulsive
ones, together with the relevant abatement techniques.

**EXPERIMENTAL AERODYNAMICS 1041535**

6 CFU

Professor Giovanni Paolo ROMANO

Theoretical knowledge and practice of methods and instruments employed in experimental fluid mechanics and aerodynamics.

Programme: Visualizations in fluid flows with examples Effects of dyes and tracer particles Laser Induced Fluorescence (LIF), Measurements of density and temperature fields: Shadowgraph, Schlieren and Interferometry Velocity field measurements: Hot Wire and Hot Film Anemometry (HWA and HFA), Laser Doppler Anemometry (LDA), Image Analysis Techniques, Particle Image Velocimetry and Particle Tracking Velocimetry (PIV and PTV). Advanced image analysis in PIV Signal analysis in fluid mechanics and relations with turbulent scales.

**LIQUID ROCKET ENGINES 1044024**

6 CFU

Professor Francesco NASUTI

The main objective is to convey basic knowledge for the study of most parts of liquid rocket engines and of the LRE system.

Course Topics: Reasons for a high chamber pressure and system designs to achieve this goal; Cooling systems in liquid rocket engines Propellant tanks; Pressure-fed systems; Basic characteristics of pump-fed systems and comparison with pressure-fed systems; Turbomachines: the macroscopic balances of mass, momentum, energy, and moment of momentum; bounds with respect to the axis of rotation; Euler’s equation for turbomachinery; methods for the analysis of flows in turbomachines; Pumps: nondimensional parameters and characteristic curves; real flow effects; cavitation. Axial turbines: nondimensional parameters, classification, performance. Impulse turbine: single rotor, pressure compounded and velocity compounded. Turbopump assembly; Gas generators: open and closed cycle architectures. Jet expansion systems: advanced nozzles.Introduction to combustion instabilities in liquid rocket engines

**MULTIBODY SPACE STRUCTURES 1041548**

6 CFU

Professor Paolo GASBARRI

Main objectives of the Course are:

- Mathematical and numerical modeling of constrained multibody Space systems.
- Numerical methods for solving orbiting multibody Space manipulators. Basic of control techniques of orbiting Space manipulators Matlab programming

Programme: Basic aspects on the Space environment: forces acting on the orbiting systems and effect of the perturbations on the orbiting spacecraft. Description of articulated joint systems for Space application (Multibody) and their movement mechanisms. Mathematical models for the study of rigid and elastic Multibodies, in a Space environment.

Techniques for the resolution of the articulated joint systems movement: algebraic-differential equation (DAE), Iteration of rigid and elastic movement. Description of the main systems for the control of satellites and orbiting bodies, an outline of guide and control for a Multibody movement. Applications and numerical examples on the Space manipulators. A multibody approach to describe a flexible launcher controlled through Thrust Vector Control.

**ROBUST CONTROL 1041453**

6 CFU

Professor Alberto ISIDORI

The course is addressed to students willing to expand their knowledge on the design of control systems in presence of model uncertainties. The course covers, in a systematic manner, various fundamental methods of analysis based on the use of linear matrix inequalities and various design methods, to be used in the case of parameter uncertainties as well as in the case of modeling uncertainties.

Programme: Stabilizability, detectability, separation principle. The stability criterion of Lyapunov for linear systems. The concept of robust stabilization: parametric

SOLID ROCKET MOTORS 1044027
6 CFU
Professor Francesco CRETA
The course will focus on the basic design of solid rocket motors (SRM) and on the wide spectrum of phenomena that characterize them. The introductory part of the course will address the main theoretical tools and mathematical models which describe the quasi-steady regime of operation. The central part of the course will focus on the multi-faceted aspect of solid propellant combustion, its description and tentative modeling. The third and last part will concentrate on SRM-specific aspects such as ablation of nozzle surfaces, two-phase flows, grain geometry and ignition transient. An outline of hybrid rocket motors will also be given. Exercises will be integrated within each part of the course.

SPACE GUIDANCE AND NAVIGATION SYSTEMS 1051389
6 CFU
Professor Fabrizio Piergentili
Objectives of the Course: Acquisition of Space guidance and navigation systems analysis and synthesis tools and the interaction with control and all the other Space vehicle subsystems

SPACE ROBOTIC SYSTEMS 1051406
6 CFU
Professor Fabio Santoni
The course provides the required knowledge to cope with the design of robotic Space systems. The main objective is the study of the guidance, navigation and control systems for missions of on-orbit-servicing, rendez-vous and docking, and planetary exploration. Programme: Spatial Description and Transformations - Control Systems of a Space Vehicle - Space Dynamical Environment - Active control systems using momentum exchange systems (reaction wheels and Control Moment Gyros). - Active control system using propulsion. Bang-bang control technique and Pulse-Width-Modulation. - Large Angle Attitude Maneuvers. - Space Manipulators - Manipulator kinematics - Inverse Manipulator Kinematics - Jacobians: Velocities and Static Forces - Manipulator Dynamics - Trajectory generation - Linear Control of Space Manipulators - Nonlinear Control of Space Manipulators - Attitude Control of the spacecraft-manipulator system - Space robotics applications: On orbit Servicing, Active Debris removal, Planetary robotics

SPACECRAFT DESIGN 1041550
6 CFU
Professor Fabio Santoni
The course describes the methodologies for the detailed design of satellites and satellite systems, including technical and project planning methods, following the international Space mission standards. Course Topics: Satellite system architecture. Requirements definition based on the mission objectives. Performance quantification and sub-systems requirements definition. International standards for Space systems design (ESA, NASA). Performance evaluation. Ground testing methods. Definition of testing equipment requirements. Launcher interface and vibration testing, thermal testing, thermal-vacuum testing, radiation testing. Vehicle mass, power, communications and data handling, cost budgets. System Optimization. Concurrent engineering methods and application to selected satellite design test cases.
SAPIENZA UNIVERSITY OF ROMA

FOR GENERAL INFORMATION ON STUDYING AT SAPIENZA
Hello – International Student Help Desk. Rectorate Building Colonnade Piazzale Aldo Moro, 5 hello@uniroma1.it Open: Monday – Friday 9:30 am to 5:00 pm

FOR INFORMATION ON ENROLLING AT SAPIENZA:
International Admissions Office Palazzo Servizi Generali Stairwell C - Second Floor Piazzale Aldo Moro, 5 settorestudi@straniero@uniroma1.it Open: Monday, Wednesday, Friday 8.30 -12.00 Tuesday, Thursday 2.30 - 4.30 http://www.uniroma1.it/didattica/sportelli/studenti-stranieri

STUDY PLAN PREPARATION ASSISTANCE
Prof. Francesco NASUTI francesco.nasuti@uniroma1.it

FOREIGN STUDENTS HELPDESK
Dr. Benedetta Ermini aerospaceengineering@uniroma1.it DIMA Via Eudossiana, 18 – 00185 Rome Open: Monday-Friday 9.00 - 12.00

STUDENT FORMALITIES
Prof. Renato PACIORRI renato.paciorni@uniroma1.it

COORDINATOR OF COMMISSION FOR ADMISSION TO THE MASTER OF SCIENCE DEGREE
Prof. Giuliano COPPOTELLI giuliano.coppotelli@uniroma1.it

ERASMUS PROGRAM
Prof. Giovanni Paolo ROMANO giampaolo.romano@uniroma1.it

LAZIODISU
Via Cesare De Lollis 22, 00185 Roma T (+39) 06 4970283-4 Open: Mon - Fri 9:00 am - 2:00 pm

SOOT ORIENTATION AND TUTORING SERVICE
Piazzale Aldo Moro 5, Palazzo delle Segreterie, Stairwell A, 4th floor Open: Mon/Wed/Fri - 8:30 to 12.00 am; Tues/Thurs 2:30 – 4:30 pm

TUITION AND SCHOLARSHIPS
Tuition fees at Sapienza University are amongst the lowest in Europe. Moreover, Sapienza offers lower tuition costs to students from developing countries. Sapienza also helps hundreds of students to reduce the cost of their education. The university provides a variety of scholarships to both Italian and foreign students based on merit and need. Moreover, other scholarships are provided by EU authorities and programmes. http://en.uniroma1.it/study-us/tuition-scholarships

SAPIENZA STUDENT CARD
The Sapienza International Office provides all students with a student card that will enable you to take advantage of special discounts, etc.

STUDENT SERVICES
Sapienza offers students a wide range of services and opportunities that makes studying here enjoyable.

CAMPUS WI-FI
You can use the campus Wi-Fi by selecting “Sapienza” from the available wireless networks. International students can access the network by using their enrolment identification number (matricula) as a username and their Infostud password.

UNIVERSITY CANTEENS
To eat at the university canteens, you have to apply for a canteen card.

SAPIENZA STUDENT CAFE
The canteen of Faculty of Engineering is at walking distance from the campus (Via delle Sette Sale 29)
http://en.uniroma1.it/campus-life/university-canoteens

INFOSTUD
The Student Information System Infostud, which is accessible from the student section of the Sapienza website, is the main tool to manage administrative procedures for students, including: registration, booking exams, viewing completed exams, printing forms and certificates such as the university fee paying slip, degree records with completed exams, enrollment certificates, etc. Infostud allows students to print certificates and documents with the University digital stamp of certification.

ACCOMMODATION
It is possible to take advantage of a special housing programme reserved for exchange students. http://en.uniroma1.it/campus-life/housing-sapienza http://www.sturent.it/

LIBRARIES
International students have access to all Sapienza libraries upon presentation of a photo ID and their student card. Each library has different regulations, so please consult the library staff for details on how to borrow books; in general, however, a photo ID and a student card or number are required. The on-line library catalogue is available at: http://opac.uniroma1.it/ If you have been a resident of Rome for more than three months, you can become a member of Rome’s public library network: Biblioteche di Roma. Membership allows you to access all of Rome’s public libraries from which you can borrow books, DVDs, use the Internet and enjoy the vast private study areas. In order to apply for membership, you must show your proof of residence in Rome, proof of enrolment and photo ID.

LIFE IN ROME
Sapienza students not only study in a world class university, they also live in a world renowned city. Rome is the ideal environment to learn about and enjoy an infinite amount of history, art and culture. It is a city full of surprises that never fails to delight the senses. Living here is an integral part of the university experience and will greatly enrich your stay at Sapienza.
http://en.uniroma1.it/campus-life/life-rome
**Bureau offices**
Building A: 1st floor Reception/Info, Cloister, Erasmus, SORT;
Building B: Ground floor Stage office

**Classroom and Libraries**
Building A: Ground floor Classrooms 13, 32;
1st floor Cloister Room, Classrooms 1, 3, 4, 5, 7, 10, 11, 12, 16, 17
2nd floor "Boaga" Library, Classrooms 15, 20, 21, 23, 24, 26, 27, 28, 30
Building B: 5th floor Classroom 4B
Building C: Ground floor Classrooms 39, 40
Building D: 1st floor Classroom 36
Building H: Ground floor Classrooms 35, 37, 38

**DIMA: Department of Mechanical and Aerospace Engineering**
Building A: ground floor Laboratories,
1st floor Direction, Administrative Secretary, Offices
1st floor gallery Dima Library, Offices
Building E: Ground floor Laboratories, Offices
Master Course in Space and Astronautical Engineering

AEROSPACE ENGINEERING

PROGRAMME

2017-18

CAMPUS LOCATION

Università degli Studi di Roma La Sapienza
Facoltà di Ingegneria Civile e Industriale