

CIVIL ENGINEERING

Description of the College of Sciences and Engineering

The College of Sciences and Engineering (Politécnico) at Universidad San Francisco de Quito USFQ trains professionals with sharp critical thinking, excellent levels of scientific and technological preparation, a comprehensive humanistic education in the liberal arts, and solid ethical principles.

Politécnico offers a wide variety of scientific and technical programs: Physics, Environmental Engineering, Civil Engineering, Agronomy Engineering, Food Engineering, Computer Science, Electronic and Automation Engineering, Industrial Engineering, Mechanical Engineering, Chemical Engineering, Applied Mathematics and Computing Engineering, and Mathematics. Additionally, Politécnico offers sub-specializations and postgraduate programs in various fields. The numerous research projects carried out by professors and students across different programs focus on both basic and applied aspects, proposing technological solutions to society's needs. The results of these projects are evidenced by the large number of specialized scientific publications, which have a high impact at the international level, as well as by the collaborations that Politécnico maintains with the local industry.

For more information, visit our website, where you can also find scholarship contests for all the programs at Politécnico to help finance your studies at the #1 University in Ecuador (<https://www.usfq.edu.ec/es/colegios-academicos/colegio-de-ciencias-e-ingenierias>).

Description of the Program

The Civil Engineering degree focuses on the study of planning, design, and construction of infrastructure that addresses or mitigates societal issues. At the same time, it examines the application of various technical solutions to solve these problems through the development of Civil Engineering projects. In this regard, infrastructure is studied across different sectors such as structures, roads, hydraulics, geotechnics, and construction project management.

Mission

The mission of the Civil Engineering degree is to train professionals within the philosophy of Liberal Arts with competent levels of technical preparation in the areas related to structures, roads, hydraulics, geotechnics, and construction project management who have critical thinking and who know how to make appropriate decisions with technical foundations to execute civil engineering projects.

Vision

Lead the training of Civil Engineer professionals in Ecuador, maintaining excellence in research and even becoming an academic reference in the region.

UNIVERSIDAD SAN FRANCISCO DE QUITO USFQ

College of Sciences and Engineering

INGENIERÍA CIVIL / CIVIL ENGINEERING

ON-SITE LEARNING MODALITY - 9 SEMESTERS

PRIMER AÑO / FIRST YEAR

ID	PRIMER SEMESTRE / FIRST SEMESTER	CREDITS	ID	SEGUNDO SEMESTRE / SECOND SEMESTER	CREDITS
ICV 2003	Taller de Ingeniería Civil <i>Civil Engineering Workshop</i>	3	ESP 1001	Escritura Académica <i>Academic Writing</i>	3
MAT 1201	Cálculo Diferencial + Ej <i>Differential Calculus + Pr</i>	3	MAT 1202	Cálculo Integral + Ej <i>Integral Calculus + Pr</i>	3
QUI 1003	Química General 1 + Lab/Ej <i>General Chemistry 1 + Lab/Pr</i>	3	MAT 1401	Álgebra Lineal 1 + Ej <i>Linear Algebra 1 + Pr</i>	3
ECN 1001	Introducción a la Economía <i>Introduction to Economics</i>	3	ARL 1002	Cosmos <i>The Cosmos</i>	3
ARL 1001	Autoconocimiento <i>Self-knowledge</i>	3	ARL 2001	Ser y Cosmos <i>The Self and The Cosmos</i>	3
ESL 0001	Inglés Nivel 1 <i>English Level I</i>	0	ESL 0003	Inglés Nivel 3 <i>English Level III</i>	0
ESL 0002	Inglés Nivel 2 <i>English Level II</i>	0	ESL 0004	Inglés Nivel 4 <i>English Level IV</i>	0
TOTAL		15	TOTAL		15

SEGUNDO AÑO / SECOND YEAR

ID	PRIMER SEMESTRE / FIRST SEMESTER	CREDITS	ID	SEGUNDO SEMESTRE / SECOND SEMESTER	CREDITS
MAT 2002	Ecuaciones Diferenciales <i>Differential Equations</i>	3	DEP 0010	Deportes <i>Sports</i>	1
FIS 2701	Física para Ing. 1 + Lab/Ej <i>Physics for Eng. 1 + Lab/Pr</i>	3	FIS 2702	Física para Ing. 2 + Lab/Ej <i>Physics for Eng. 2 + Lab/Pr</i>	3
ICV 2002	Topografía + Lab <i>Topography + Lab</i>	3	ICV 2004	Diseño Vial + Lab <i>Roads Design + Lab</i>	3
ARTE	Arte: ART/MUS/DAN/TEA <i>Art:ART/MUS/DAN/TEA</i>	3	PRC 2000	Aprendizaje y Servicio PASEC <i>Service Learning PASEC</i>	3
HUM	Humanidades LIT/FIL/ESC/ARH <i>Humanities: LIT/FIL/ESC/ARH</i>	3	ICV 2001	Estática + Ej <i>Statics + Pr</i>	3
ESL 0005	Inglés Nivel 5 <i>English Level V</i>	0	ELECTIVA 1	Electiva Libre 1/2 <i>Free Elective 1/2</i>	3
ESL 0006	Inglés Nivel 6 <i>English Level VI</i>	0	TOTAL		16
TOTAL		15			

TERCER AÑO / THIRD YEAR

ID	PRIMER SEMESTRE / FIRST SEMESTER	CREDITS	ID	SEGUNDO SEMESTRE / SECOND SEMESTER	CREDITS
GST 0010	Cultura Gastronómica <i>Gastronomic Culture</i>	1	ICV 3002	Ing. de la Construcción + Lab <i>Construction Engineering + Lab</i>	3
ADM 3002	Emprendimiento <i>Entrepreneurship</i>	3	ICV 3003	Hidráulica + Lab <i>Hydraulics + Lab</i>	3
ICV 3001	Mecánica de Fluidos <i>Fluid Mechanics</i>	3	ICV 4301	Hormigón Armado 1 <i>Reinforced Concrete 1</i>	3
IME 3005	Mecánica Materiales + Lab/Ej <i>Solid Mechanics + Lab/Pr</i>	3	ICV 3004	Mecánica de Suelos + Lab <i>Soil Mechanics + Lab</i>	3
ELECTIVA 2	Electiva Libre 2/2 <i>Free Elective 2/2</i>	3	ICV 3201	Análisis Estructural 1 + Ej <i>Structural Analysis 1 + Pr</i>	3
CCSS	CCSS: HIS/SOC/ANT/POL/REL/PSI	3	TOTAL		15
TOTAL		16			

CUARTO AÑO / FOURTH YEAR

ID	PRIMER SEMESTRE / FIRST SEMESTER	CREDITS	ID	SEGUNDO SEMESTRE / SECOND SEMESTER	CREDITS
ICV 4003	Cimentaciones y Muros <i>Foundations and Walls</i>	3	ICV 4004	Ingeniería de Costos <i>Construction Engineering</i>	3
ICV 4001	Ingeniería Geotécnica + Lab <i>Geotechnical Engineering + Lab</i>	3	ICV 5004	Ing. Sismo-Resistente + Lab <i>Earthquake Engineering + Lab</i>	3
ICV 4005	Diseño de Pavimentos + Lab <i>Pavement Design + Lab</i>	3	ICV 4302	Hormigón Armado 2 <i>Reinforced Concrete 2</i>	3
ICV 4401	Estructuras de Acero 1 <i>Steel Structures 1</i>	3	ICV 4002	Ingeniería Sanitaria <i>Sanitary Engineering</i>	3
ICV 4202	Análisis Estructural 2 + Lab <i>Structural Analysis 2 + Lab</i>	3	OPT 1	Optativa Ing. Civil 1/2 <i>Civil Engineering Elective 1/2</i>	3
TOTAL		15	TOTAL		15

ID	VERANO / SUMMER	CREDITS
PAS 4000	Práctica Pre-Profesional PASEM <i>PASEM Professional Practicum</i>	5
TOTAL		5

QUINTO AÑO / FIFTH YEAR

ID	PRIMER SEMESTRE / FIRST SEMESTER	CREDITS
ING 0001	Coloquios <i>Colloquium</i>	1
ICV 4006	Análisis Computacional en ICV <i>Computational Analysis in CE</i>	3
ICV 4080	Gerencia de la Construcción <i>Construction Management</i>	3
OPT 2	Optativa Ing. Civil 2/2 <i>Civil Engineering Elective 2/2</i>	3
ICV 5992	Proyecto Integrador ICV <i>Senior Project</i>	5
TOTAL		15

TOTAL CREDITS: 142

3 credits are equivalent to 144 hours

This curriculum may be subject to non-substantial changes in accordance with Article 110 of the Academic Regulations, issued by the Higher Education Council (CES). The curriculum applicable to each student will be the one in effect at the time of their graduation. Any changes that are processed will be made to this digital version published on the website of the University to which the student of USFQ must refer

INGENIERÍA CIVIL / CIVIL ENGINEERING

ON-SITE LEARNING MODALITY - 9 SEMESTERS

The sequence of subjects in the curriculum from the second semester onward is a recommendation considering that some subjects are prerequisites for subsequent subjects. The system is calibrated so that students can register for the number of credits listed in the curriculum.

GENERAL COLLEGE COURSES AND GRADUATION REQUIREMENTS

Some General College courses are fulfilled with designated courses for this purpose by each major. When a major designates a particular subject to meet the General College requirement, that subject requires a passing grade of C.

English as a Second Language Levels ESL (B2 Common European Framework)

Students are assigned an English level (English as a Second Language ESL) based on the proficiency test taken during the admission process. Students can also validate their English knowledge with international certificates detailed in the Foreign Language Learning Proficiency: English section of the Student Handbook. To meet the mandatory graduation requirements, all students must demonstrate English proficiency by achieving the required score on USFQs proficiency test, presenting an international certificate of English validated by USFQ, or completing USFQs ESL levels through Level 6.

To take courses in any academic area in English and courses in other languages, ESL requirements must have been formally and successfully completed.

Academic Writing (ESP 1001)

Students are encouraged to take Academic Writing early in their career. The minimum passing grade for this General College requirement is C.

Mathematics

The General College MATHEMATICS requirement is met with the course MAT 1201 Differential Calculus + Pr. The minimum passing grade for this General College requirement for this major is C.

Sciences

The General College SCIENCES requirement is met with the course QUI 1003 General Chemistry 1 + Lab/Pr. The minimum passing grade for this General College requirement for this major is C.

In some cases, to meet General College requirements, students must choose a subject from various academic areas (check in the curriculum and see details below).

Arts

The ART requirement is met by passing any course in the academic areas detailed below. The minimum passing grade for this General College requirement for this major is D.

ART - Art
DAN - Dance
TEA - Theater
MUS - Music

Social Sciences

The SOCIAL SCIENCES requirement is met by passing any course in the academic areas detailed below. The minimum passing grade for this General College requirement for this major is D.

ANT - Anthropology
EDU - Education
HIS - History
REL - International Relations
POL - Political Science
SOC - Sociology
PSI - Psychology

Humanities

The HUMANITIES requirement is met by passing any course in the academic areas detailed below. The minimum passing grade for this General College requirement for this major is D.

LIT - Literature
FIL - Philosophy
ESC - Creative Writing
ARH - Art History

Community Service Learning and Service PASEC (PRC 2000)

Community service is fulfilled through the LEARNING AND SERVICE PASEC seminar. Students must attend classes and also complete community service hours.

Professional Practicum PASEM (PAS 4000)

The students can start completing PASEMs Professional Practicum requirements from the sixth semester and/or with 75 approved credits, they must complete a minimum of 240 hours. Students must enroll in PASEM in the last summer according to their curriculum, the class is approved with the internship hours and the

theory component of the class. The student must ensure that the class end date coincides with his/her last semester.

Sports (DEP 0010)

Every student must choose a SPORTS class from the various options offered each semester.

Gastronomic Culture (GST 0010)

Every student must take a GASTRONOMIC CULTURE seminar from the second semester onward.

Colloquiums

The Colloquium requirement varies by major. Check with the Academic Dean of each College.

Course in English

The student must register in any course taught in English, either from their major or from the General College. Courses with a code ending in (E), (e.g., ADM 1001E), are taught in English. Any course taught in English will have ESL 0006 English Level 6 as a prerequisite.

Writing Intensive

The student must pass any course with the Writing Intensive attribute. To register for a Writing Intensive course, students must have passed all ESL levels. Writing Intensive courses can be identified with a specific icon in the Offered Courses Catalog each semester.

Free Electives

Any subject that is not a mandatory requirement in the curriculum can serve as a Free Elective for General College. Free Electives can be used to meet the demands of a second major or a minor.

Ser Dragón (COL 2000)

Ser Dragón is an accompaniment seminar for first-semester students that aims to facilitate the transition from high school to university life. Every student who has enrolled from semester 202210 onward must take and pass COL 2000. The passing grade for this requirement is P.

All subjects offered by the College of Sciences and Engineering must be passed with a minimum grade of C.

*Civil Engineering electives are modified or updated each semester. Students must request information about their options from the program's coordination.

ADDITIONAL ACTIVITIES OF THE PROGRAM

Research and other Academic initiatives

Some of the aspects associated with international research collaboration, as well as cooperation with other programs of the university and with industry, are described in this section, emphasizing when current CE students are part of the achievements.

Publications

The CE program maintains a firm commitment to excellence in research, standing out as a leader in the field of Civil Engineering throughout Ecuador. Despite of its modest size, the CE faculty consistently achieves remarkably high academic performance, reflecting the exceptional quality of its research efforts. Most of its publications are indexed by Scopus with an average of 45 publications per year. A summary of the number of publications and students involved in those publications is provided below:

Table 1. Summary of conference papers and CE student participation

Academic Year	Number of publications	Number of students involved
2022 - 2023	20	14
2023 - 2024	26	10

Table 2. Summary of journal papers and CE student participation

Academic Year	Number of journal publications	Number of conference papers
2022 - 2023	22	15
2023 - 2024	27	9

International Research and Academic Collaboration

CE program maintains productive international research cooperation associations with several universities such as Minho University (Portugal), TU Delft (The Netherlands), Los Andes University (Colombia), Universidad Católica de Chile (Chile), Missouri University of Science & Technology (USA), among others. These associations let faculty members develop research projects in their different areas of expertise. Also, students are encouraged to become involved as research assistants or participants in different activities related to these research projects and the development of the related publications. Students are also encouraged to participate in paper competitions, internships and conference presentations related to these projects. A summary of the number of projects and publications, related to international research cooperation is provided in Table 3.

An important academic program is also currently developed between CE program and the Mining Engineering Program at the Missouri University of Science and Technology (MS&T). In addition to jointly seminars and conferences that are annually organized and offered to local mining industry professionals as well as to USFQ faculty and students, there is a specific agreement between the 2 programs. This agreement allows CE students to be transferred to MS&T during their third year of studies at USFQ. After an additional two years of study, they can earn Bachelor of Science in Mining Engineering awarded by MS&T. This is a unique opportunity for CE students to receive an international education and experience in an area which is related to Civil Engineering. There is a scholarship fund made up of contributions from MS&T and multinational mining companies operating in Ecuador, which helps CE students who choose this option to partially cover all the expenses involved in relocating, living and studying in Missouri for 2 years.

Table 3. Summary of international research cooperation projects

Academic Year	Number of projects	Number of publications	Number of students involved
2022 - 2023	14	23	4
2023 - 2024	21	27	3

Cooperation with other USFQ programs

Another strategy to strengthen the projects of the CE program consists of collaborating with other areas of the USFQ. Currently, CE faculty and students are collaborating with partners of Electronic Engineering, Chemical Engineering, Computer Science and Architecture Programs. By fostering these collaborations, the CE program can leverage diverse expertise and resources to enhance the scope and impact of its research projects. A summary of the number of projects and students involved in these projects is provided below:

Table 4. Summary of projects that includes cooperation with other USFQ programs

Academic Year	Number of projects	Number of publications	Number of students involved
2022 - 2023	6	1	1
2023 - 2024	16	3	6

Cooperation with Industry

Establishing alliances with the industry is essential for the CE program. Through these partnerships, students gain very valuable hands-on experience, working on real-world projects and challenges. Access to industry resources enhances research capabilities and enables the exploration of innovative solutions to complex engineering problems. Additionally, industry collaborations provide students with networking, internship, and job placement opportunities, facilitating their professional development and preparing them for successful careers in the field. A particular project of this type is listed below.

HOLCIM

The collaboration between the CE program and the concrete/cement supplier company Holcim Ecuador S.A. aims to develop innovative mixtures for flexible pavements using recycled aggregates, local natural fibers, and pozzolanic cement. Holcim, a leading producer of clinker, cement, and concrete, seeks to improve technical expertise in cementitious materials, while USFQ, a renowned higher education institution, specializes in sustainable construction materials and utilization of circular materials. The collaboration aligns with the objectives of both parties to advance knowledge in sustainable infrastructure development and promote cooperation between industry and academia. In addition, there is another relevant educational initiative. Every semester, HOLCIM experts participate as invited lecturers and are in charge of 6 classes (called Holcim Academia) that are additional to the normal classes of the CE Construction Engineering course. Students have the opportunity to increase their knowledge in cement and concrete technology, directly from the experts in the area who are linked to the day by day professional practice.

Community Outreach

The CE program constantly works on community outreach projects. The main objective of these projects is to generate a benefit for the community, with the participation and collaboration of both students and CE faculty. These projects also represent an excellent opportunity for students to apply the knowledge they have gained in actual projects. Some of the most recent projects of this type include a) the water treatment with autonomous chlorinators for human consumption, b) the dissemination of knowledge with the Ecuadorian construction sector, and other activities. Details of these projects are listed below.

a) Water treatment with autonomous chlorinators for human consumption

The project aims to provide sustainable solutions that allow access to safe water for human consumption to communities that do not have access to drinking water. To meet this challenge, the project has the support of the Canadian non-profit humanitarian organization "Water Ambassadors Canada" (WAC), which has donated autonomous water chlorination units through its international contacts. In addition, the project has been executed on several occasions with the assistance of the "Engineers Without Borders Ecuador" chapter and with the participation of master's students in civil engineering from TU Delft University and undergraduate CE students from USFQ. More than 600 people have benefited from the installation of chlorinators. A link is provided for further information.

<https://www.usfq.edu.ec/es/proyectos/tratamiento-de-agua-con-cloradores-autonomos-para-consumo-humano>

b) Dissemination of knowledge with the Ecuadorian construction sector

As part of a project Linking with Society, the CE Faculty contributes with virtual, in-person, audiovisual, or written presentations on topics relevant to the professional practice in the construction industry, using digital tools, presentations, and publishing papers in local technical magazines. These papers or exhibitions contain the knowledge generated and developed in the Program, with the support of students and the collaboration of both internal and external colleagues. These contributions are available free of charge in physical copies or on web pages, benefiting various factors such as construction companies, public institutions, and interest groups such as engineers, architects, builders, and academia. In many of such initiatives, CE students support CE faculty, an also dissemination material is sometimes considered as part of the CE course materials. One key partner in this activity is the Construction Industry Chamber that is an institution where companies and professionals related to the construction sector of the country are members. A link is provided for further information.

<https://www.usfq.edu.ec/es/proyectos/diseminacion-de-conocimiento-con-la-comunidad-del-sector-de-la-construccion-en-el-ecuador>

Based on the projects mentioned in sections a) and b), a summary of the community outreach projects is presented below.

Table 5. Summary of community outreach projects

Academic Year	Number of projects	Number of students involved
2022 - 2023	2	24
2023 - 2024	2	16

c) College of Sciences and Engineering open house, high school visits, and others

The CE program is involved in additional community outreach activities. These activities involve:

- **Engineering fair:** During this evaluation period, several CE students presented posters and prototypes of projects developed in their courses and also their Senior projects in two engineering fairs (open to the public), one in each academic year.
- **College Sciences and Engineering open house:** During this evaluation period, professors and students participated in two open houses, one each academic year.

- **TECHCamp:** This is an innovative project aimed to tenth, eleventh, and twelfth grade high school students, offering an immersive experience in science and engineering. Through hands-on activities and projects in the laboratories of the USFQ College of Sciences and Engineering, participants explore different engineering areas encouraging teamwork, creativity, and critical thinking. This camp provides high school students with the opportunity to develop skills relevant to their academic and professional future while exploring their interest in science and engineering in a stimulating environment.
- **Other events:** Other events such as talks and vocational guidance activities, also have the participation of the CE faculty. These events serve as valuable platforms for students to gain insight into various aspects of the field, including career paths, industry trends, and professional development opportunities. Through engaging talks and mentoring sessions, students can explore their interests, receive practical advice, and connect with professionals in the field of civil engineering, further enriching their educational experience and preparing them for future projects.

Student Experience

This section describes activities in which CE students have a significant role. These activities include a) the participation of students in the American Concrete Institute (ACI) Student Chapter of USFQ, b) the participation of students in field visits, c) their attendance to conferences and speeches organized by CE-related organizations, d) their attendance to international contests, and e) the organization of social events within the career.

a) ACI-USFQ Student Chapter

The ACI-USFQ Student Chapter, established in 2015, stands as the first official student chapter of the American Concrete Institute (ACI) in Ecuador. Throughout its nine years of existence, more than 90 students have participated in more than 16 international conventions, achieving more than 12 victories in inter-university competitions. These milestones have led to USFQ being recognized as an “ACI Excellent University” for nine consecutive years (2015-2024). In March 2024, a team of USFQ Civil Engineering students managed to qualify their undergraduate research for the first time to be presented at the undergraduate session of the ACI International Convention in New Orleans, USA.

b) EWB-USFQ Student Chapter

The EWB-USFQ Student Chapter, established in 2015, has brought opportunities for students to participate in service projects to support vulnerable communities throughout different types of projects. Such projects allow students to learn about other realities and apply their technical knowledge and empathy to overcome real life social and technical constraints. In 2023 and 2024, students have also incorporated and published their work in different forums and academic papers. EWB-USFQ Student Chapter is constantly evaluating potential new projects to undertake.

c) Field visits

Field visits are an integral part of the educational process, providing students with the opportunity to apply theoretical concepts learned in the classroom to real situations in the field. During these visits, students can observe first-hand ongoing construction projects, existing infrastructure, and specific engineering problems in their local environment. This allows them to better understand the practical challenges that civil engineers face in their daily work and gives them a broader perspective of the construction industry. Additionally, field visits encourage teamwork, problem solving, and real-time decision making, preparing students for their future careers in civil engineering.

d) Conferences and Speeches (ACI, EWB, and CE Program)

The CE Program and student chapters such as ACI (American Concrete Institute) and EWB (Engineers Without Borders) organize different conferences and seminars. These events feature expert presentations intended to address contemporary issues and provide additional knowledge to professionals in the field. By attending these events, civil engineers gain valuable knowledge about the latest developments, innovative techniques, and best practices in civil engineering.

e) International Contests

As mentioned above, CE students are encouraged to participate in the ACI international conventions. Throughout its nine years of existence, more than 90 students have participated in more than 16 international conventions, achieving more than 12 victories in inter-university competitions. CE program encourages and support (technical advice and airfare support) CE students to participate in the American Concrete Institute (ACI) Students Competition, at least once every year. ACI Competitions permit students to learn, to investigate and to practice updated aspects related to the concrete technology, and at the same time allow them to compete against teams from the most prestigious universities in the world.

f) Social Events (ACI, EWB)

The ACI and EWB Chapters organize different social events to promote the integration of CE program students. These events are usually held annually, and some of them are described next.

- **CE integration:** event held once every year with all the ACI Chapter members. All the CE program's students are invited. The events are held in a private facility. Different sporting activities, a group meal, and an integration party are included in this daylong activity.
- **Soccer tournament:** The chapters organize a daylong soccer tournament in which all students can participate. This tournament is typically held on a Saturday.
- **Card tournament:** Chapters also host a card tournament, inviting all students to join. Participants form teams and compete in a day-long card tournament that offers the opportunity to engage in friendly rivalry and strategic play. This event promotes social interaction, mental agility, and recreational enjoyment among students within the academic community.