40 years of training
1983 - 2023

University Diploma in Gemmology (DUG)

Information booklet

English notice

Faculté des sciences et des techniques

GemNantes
Recherche et formation en gemmologie

univ-nantes.fr/sciences

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CONTACT

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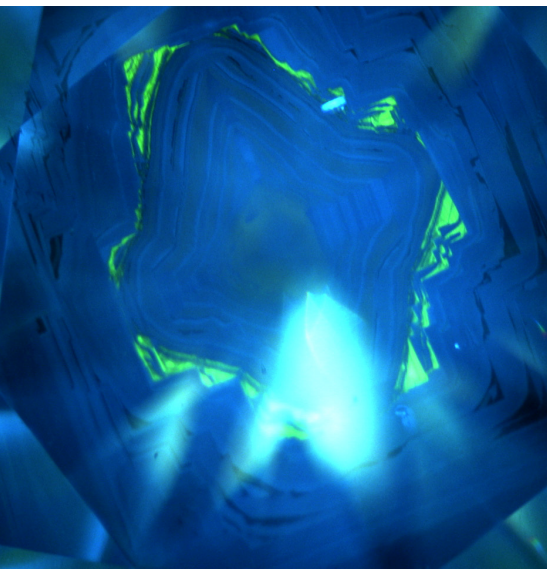
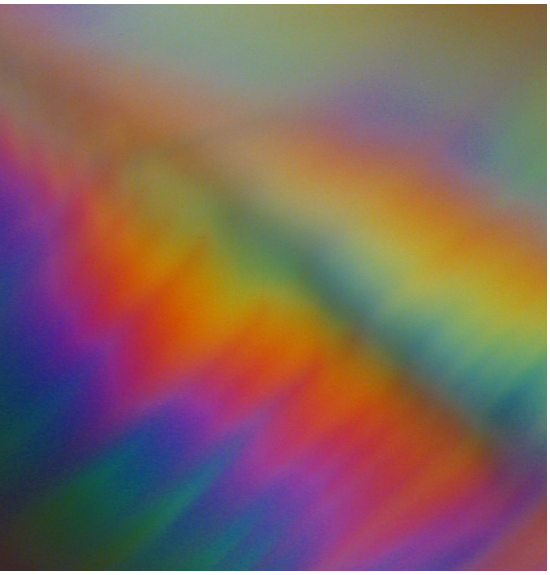
A BRIEF HISTORY & OBJECTIVES



Cuboid growth in a natural diamond seen in luminescence. Photo LFG



Uranium-bearing hyalite from Zacatecas, Mexico, seen between crossed polarizers. Photo E. Fritsch

Since the proliferation of synthetic gem materials (and artificial products) in the 1970s and 1980s, followed by a boom of gem treatments starting in the 1990s, it was quickly realized that the simple methods of classical gemology, although very powerful, were not sufficient to solve all cases satisfactorily (e.g. HPHT-treated diamonds, B jade or Zachery-treated turquoise). Facing the continuous increase of challenges in the identification of gems, members of the trade have demanded reliable gemological reports and evaluations, based on a scientific expertise, especially for high value-added gemstones. The creation of a large number of gemological laboratories, and a spectacular expansion of the existing ones, accompanies this demand.

The increasing complexity in gem identification leads the gemological laboratories to routinely use a number of non-destructive techniques borrowed from physicists or chemists (e.g. optical spectroscopies and mass spectrometry). However, these analytical methods largely exceeded the level of education required to obtain a basic gemology diploma (GG, FGA, DGA and the many other diplomas around the world). Many users of these techniques are self-taught, with a limited or no specific schooling, preventing them to master all the important aspects of data collection and interpretation.

The DUG was created in 1981 for all these reasons. It aims at providing classical gemologists with an **introduction to the scientific method**, applied to gemology, whether they are already scientists (in other fields), members of the trade, or enlightened connoisseurs. The student learns **the basics of the laboratory techniques now used routinely in gemology**. For each of them, the classes offer **simplified theory**, and then insist on the **practical applications**, along with the **limitations of the method**. Perhaps even more importantly, the student is given **an overview of the general knowledge necessary to interpret the results correctly**. To complete assignments and examinations, the gemologist has to **learn to structure his (her) results and thoughts**, by **filling a worksheet, and writing a bibliographic report and an experimental report**.

DURING THE DUG, YOU WILL:

Extend your culture in scientific subjects that are connected to gemology, including but not limited to :

- Crystallography and its many uses in classical gemology, spectroscopy and microscopy
- Crystal growth
- Origin of color and colorimetry
- Basic chemistry and related notions
- Basic geology and its application to gem deposits
- Inclusions and its relation to geologic and geographic origin

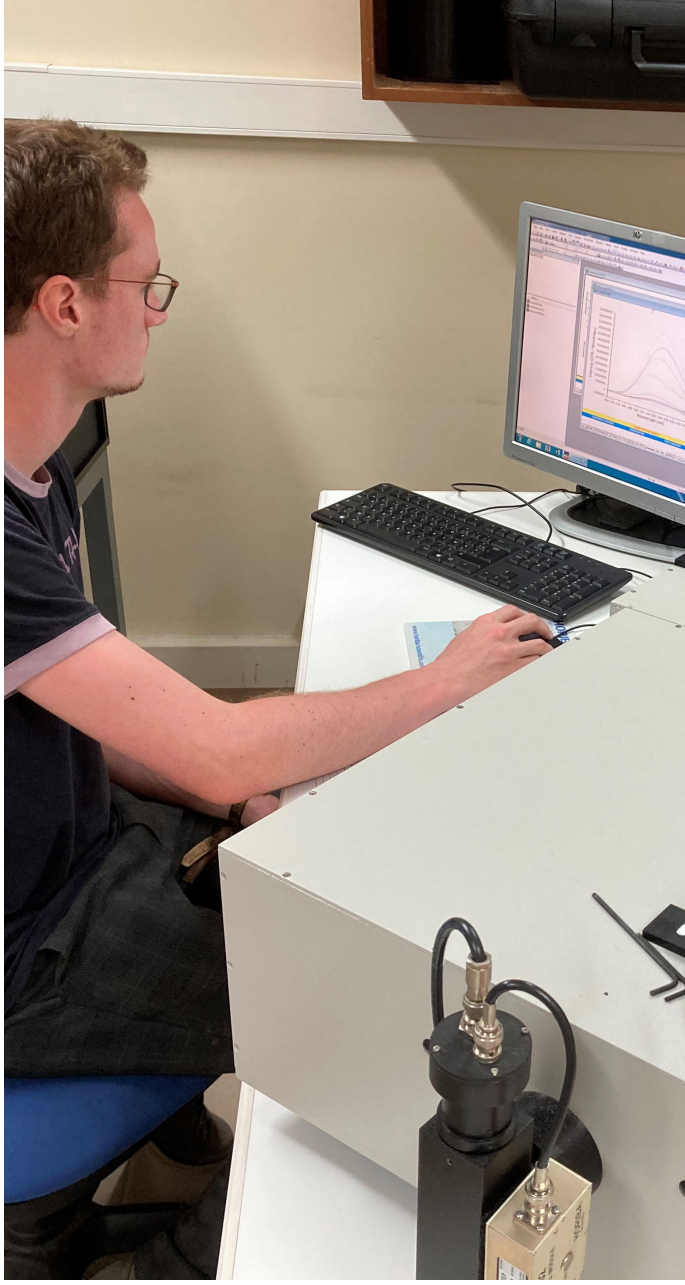
Acquire the basic theoretical aspects behind each technique used in gemology (e.g. vibrational spectroscopy, chemical X-ray fluorescence analysis, mass spectrometry …).

Be able to select the proper methods/techniques of investigation for a given gemological problem:

- adequate identification criteria for synthetic gems such as diamonds, amethyst, moissanite
- adequate identification criteria for treated gems like treated-color diamonds (including HPHT treatment), B jade, and treated corundum (fracture-filled and Be-diffused)

Operate the following scientific instruments properly on your own:

- Optical spectrometers: including UV-visible-near infrared absorption, (mid-)infrared absorption, Raman spectrometer, luminescence spectrometer.
- X-ray chemical microanalysis: Energy Dispersive Spectrometry
- Scanning Electron Microscopy (basic operations only).



If a photoluminescence spectrometer may appear intimidating at first, we have experience in teaching how to use it, even for students with absolutely no scientific background, and it works! You will even learn how to interpret the simpler results. Photo E. Fritsch.

Learn to check properly the quality and the relevance of data extracted from each instrument.

Provide first-degree interpretation to classic absorptions or features, for example origin of color or luminescence.

Master the bases of the scientific method, conduct rigorous deductions from observation, spectra, analyses and other data.

Know how to combine information in a well-documented, consistent argumentation and conclusion

Write a well-structured and well-documented report, based on adequate literature references and experimental data.

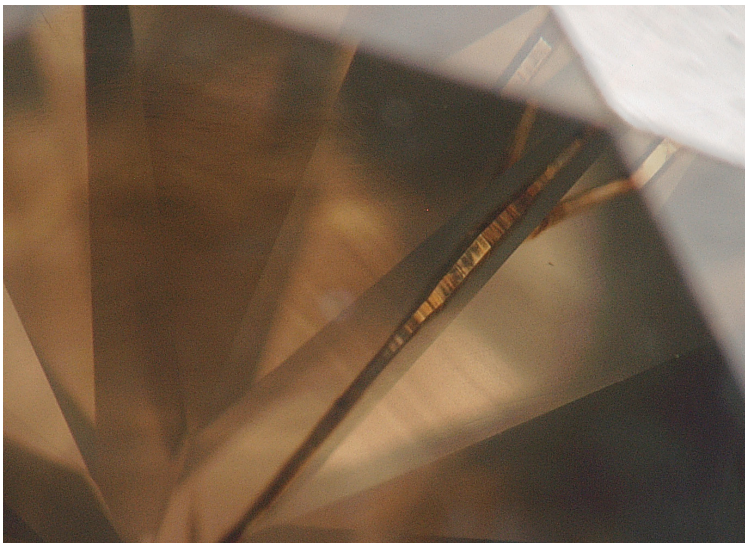
Recognize that your knowledge has limits and know where to get help when necessary.

Compared to classic university degrees, the DUG is **adapted to those who have no scientific background at all**. Thus bench-jewelers, designers or those with a literature or history background do succeed in obtaining their diploma. We are careful to introduce notions of physics and chemistry with the simplest vocabulary (we utilize only the strict minimum of technical terms).

This education is **directly applied to the concerns of the gem trade**. Once general concepts have been established, the classes are aimed directly at gemological applications and practice. All professors are gemologists.

The DUG program is **supported by an internationally recognized research program**, dealing with many gemological challenges, demonstrating an experience covering a large number of gems, including all important ones. This research is not limited to a subset of gems or experimental techniques. **Some of the criteria taught during the course have been invented by the teachers themselves**, a rare privilege. These criteria are almost always validated through publication in international scientific journals with a review board, a guarantee of the highest quality. Thus, students benefit from an **up-to-date education, scientifically validated, based on a vast database of bibliography and experiments**. **Many laboratories or schools around the world contact us regularly to hire high-quality gemologists**. Many of our former students are now in major laboratories or gemological organizations.

Typical inclusion of a high-temperature treated ruby.
Photo LFG



A graphic dissolved dislocation in a natural brown diamond.
Photo LFG

Incredible dissolved dislocations in a natural type IIa diamond.
Photo LFG

PREREQUISITES

Are admitted to register for this program:

- Graduates of well-recognized classical gemology courses (American GG, English FGA, German DGG, etc.), the European Gemology Diploma (FEEG) or diplomas from the LFG, ING or IBS in France.
- Students in mineralogy or geology at the masters level with a professional project in gemology, and ready to acquire through personal work a basic gemological education.
- Candidates without a classical gemology diploma may ask first for the equivalence with such diplomas based on their experience. In this case, the university often requests that the candidate takes additional classes or courses, to complement the candidate's current knowledge. This procedure is little used for overseas applicants, and in France may apply to jewelers, gem dealers, lapidaries, or diamantaires for example.

In general, applicants are expected to know how to use the most common gemological instruments, and be familiar with the most common gems, in their natural, treated or synthetic varieties. They should know the criteria based on classical gemology used to separate natural from synthetic and treated gem materials.

Pearls can be studied using various spectroscopies

TUITION

Tuition for the regular program is 6825 Euros. This includes:

- Academic registration, participation in the expenses for lab sessions necessary to complete the student's experimental and bibliographic work with adequate instrumentation and access to proper bibliography resources.
- Adequate time of use for instruments and facilities. Any overtime not agreed to by the program director will be charged.
- The paying use of instruments outside the University of Nantes is evaluated on a case by case basis.

IV ADMINISTRATIVE ASPECTS

- The diploma is managed administratively by the FOCAL service (dedicated to continuing education) at the Faculty of Sciences and Technologies («UFR Sciences et Techniques»), Nantes University.
- The diploma includes **6-weeks of classes** (Monday through Friday), adding up to 210 hours. Each student is further entitled to 10 hours of personal coaching adapted to his or her particular needs, mostly dedicated to interpreting experimental results and general organization of the experimental report.

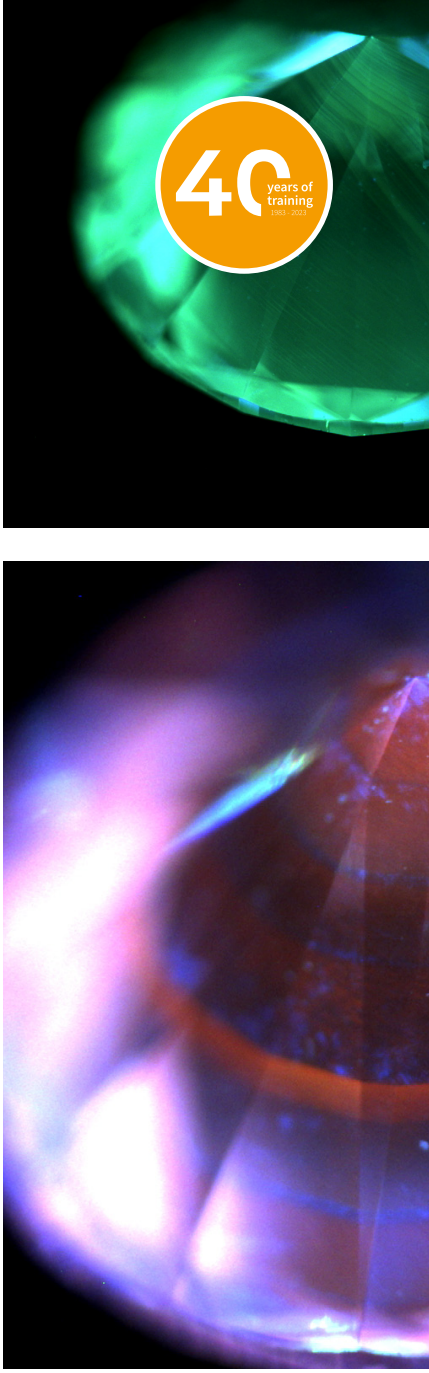
V TEACHING ASPECTS

Professor Emmanuel FRITSCH is responsible for the academic aspects of the DUG diploma.

The Faculty of Sciences and Technologies institutes an Academic Council composed of:

- A representative of the Faculty of Sciences and Technologies,
- Teachers participating in the diploma,
- If needed, representatives of the trade.

This Academic Council meets once a year, and is in charge of the coordination and follow-up of the teaching.



These two CVD synthetic diamonds show their typical growth pattern in luminescence.
Photo LFG

VI TEACHING STAFF

Teaching personnel from the Faculty of Sciences and Technologies at the University of Nantes:

Dr. **Emmanuel FRITSCH**, Professor, GG.
Dr. **Camille LATOUCHE**, Associate Professor.
Jean Rouxel Institute of Materials (Institut des Matériaux Jean Rouxel - IMN)

Trade teachers

Mr. **Franck NOTARI**, DUG, Director. GGTL Gemological Laboratories, Geneva, Switzerland
Dr. **Stefanos KARAMPELAS**, DUG, Chief Gemologist, responsible for the laboratory section. LFG laboratory, Paris
Dr. **Boris CHAUVIRE**, DUG, General Director. Geogems, Guérande

VII DUG SYLLABUS

7-1 Checking and improving your own classical gemology knowledge.

7-2 Searching for information and documents.

- Rules to create your own bibliography file,
- How to deal with internet information, and on-line databases,

7-3 Analytical laboratory techniques including:

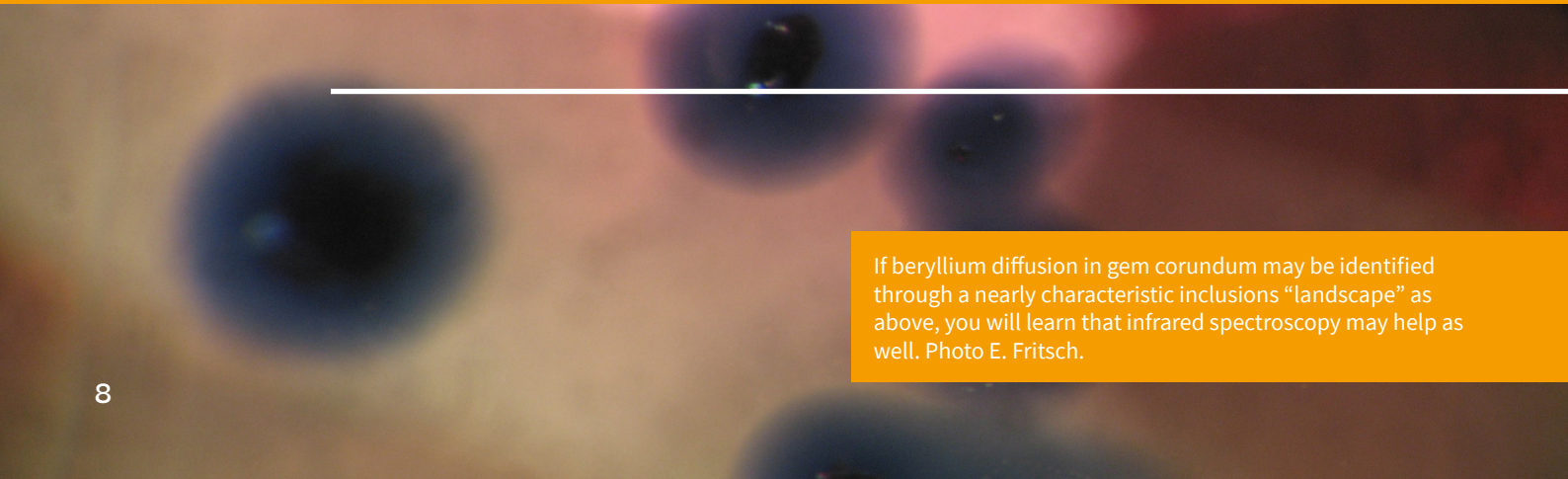
- Ultraviolet-Visible-Near-Infrared (UV-Vis) absorption spectroscopy
- Fourier-Transform InfraRed (FTIR) absorption spectroscopy
- Raman scattering spectroscopy
- Luminescence: imaging techniques and luminescence spectroscopy.
- X-ray fluorescence (XRF) spectrometry and other chemical analysis techniques using energy or wavelength dispersion (electron microprobe, EDS, PIXE, etc.).
- Mass spectrometry: LA-ICPMS and other varieties of mass spectrometry useful in gemology
- Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM) and associated EDS chemical microanalysis
- Radioactivity for gemologists
- X-rays: diffraction, radiography, topography & tomography.

7-4 General subjects:

- The scientific method, methodology for laboratory gemologists, writing an experimental report and a bibliographic report.
- Crystallography, morphology of crystals and notions of X-ray crystallography
- Geology of gem deposits
- Crystal growth of natural and synthetic crystals
- Microphotography: basic rules
- Origin of color and luminescence, defects in crystals
- Geographical origin of gems: basic notions
- Identification of pearls: basic notions

7-5 Synthetics and treatments:

- Physical and chemical treatments of gem materials (heat, irradiation, diffusion, impregnation, etc.): diamond, corundum, and jade in particular.
- Important synthetics: CVD and HPHT synthetic diamonds, synthetic amethysts, synthetic moissanite.



If beryllium diffusion in gem corundum may be identified through a nearly characteristic inclusions “landscape” as above, you will learn that infrared spectroscopy may help as well. Photo E. Fritsch.

VIII RULES OF EVALUATION - EXAMS

Exams are organized by units which can be accumulated over successive years: each validated module (average above 10/20) is valid for three years.
To validate a module the candidate must obtain a grade of a least 10/20.
To validate the entire diploma the candidate must obtain at least 50/100. Modules may compensate each other, that is one can obtain one's diploma despite one or two grades below 10/20. ***However, in the case of absence at an exam (inducing a grade of 0 for the module), the diploma will not be awarded.***

MODULES	METHOD	GRADE	CONTINIOUS ASSESSMENT	EXAM
Module 1 Bibliographic research dissertation	Written	/20	100%	
Module 2 Experimental dissertation	Written	/20		100%
	Oral	/20		100%
Module 3 Gemology theory	Written	/20	50%	50%
Module 4 Practical Gemology	Written	/20	50%	50%

« Final exams»: These are the written exams of Modules 3 and 4 (see below details). They are grouped in one day, which follows immediately week 6 (first working day, generally a Monday). The written exam for Module 3 (theory) takes place in the morning, and that of Module 4 (practical) in the afternoon.

MODULE 1- BIBLIOGRAPHIC RESEARCH DISSERTATION
Written ongoing evaluation: Bibliographic dissertation. The subject of this memoir is established at the end of week I of the DUG, and the bibliographic dissertation must be deposited during week IV. This dissertation is a synthesis of published articles on a specific subject of gemological interest chosen together by the student and the teaching staff.

MODULE 2- EXPERIMENTAL DISSERTATION

This experimental dissertation is due about 6 months after the end of classes (according to calendar and availability), to provide time for students to finish their practical work (which may be done in part at the IMN).

Written dissertation: The main report of this diploma, based on experiments conducted by the student himself on gems provided by the students or the teaching staff, depending on situations and subjects. It must demonstrate that the student is capable of using at least some of the techniques studied during the classes. It is expected of the student to demonstrate that he or she understands and follows the scientific method in presenting the results obtained on a limited gem sampling. It is submitted to the jury at least two weeks before the oral defense.

Oral examination: Public defense of the experimental dissertation above in front of the jury. The oral presentation is 15 minutes long, and is followed by about 45 minutes of questions by the jury.

MODULE 3- GEMOLOGY THEORY

The continuous assessment consists in a series of simple questions ("quiz") on subjects studied so far in the diploma, mostly in the preceding DUG week. It is part of a short written exam, 30 minutes long, without documents, during weeks 2, 3, 4, 5 and 6.

Final written exam: It is a list of questions sampled from all the courses, lasting two hours, without documents. It is essentially a long "quiz", in the same style as the weekly "quiz", but covering all the topics taught during the 6 weeks. It takes place in the first working day (usually Monday) of the week 6 in the morning.

MODULE 4- PRACTICAL GEMOLOGY

The continuous assessment consists in a series of practical, not academic, questions ("quiz"). It is part of a short written exam, 30 minutes long, without documents, during weeks 2, 3, 4, 5 and 6.

Final written exam: Establish a correct conclusion as to the nature (natural, synthetic or treated) of gem materials on the basis of virtual worksheets provided with gemological properties (including inclusions pictures), spectra and measurements. It lasts three hours, with documents. The most important aspect is to correctly justify the conclusions proposed. It takes place the first working day (usually Monday) of the week 6 in the afternoon.

Melee synthetic diamonds are now part of the market and our program discusses several aspects of this relatively new challenge. Photo LFG.

IX OBTAINING THE FINAL PAPER DIPLOMA

The final paper diploma takes about a year to be produced (checked, transmitted to various services, printed, signed by the president, etc.) It is then available at the reception of « Scolarité » (registration) of the Faculty of Sciences and Technics in Nantes (morning 08:30 to 12:45; as of 2023). The laureate may come get her/his diploma in person with a valid ID card or passport.

OTHER POSSIBILITIES

1. Diplomas may be mailed to students within the European Community (« lettre suivie » outside France; “Recommandé AR” in France). To this end, send the person in charge (see below) an email specifying that you wish your DUG diploma, indicating your full name, a photocopy of a valid ID (both sides if applicable), and of course the detailed address to which you send the paper to be sent.
2. For foreign students outside the European Community, your diploma will be sent through diplomatic services to your own country’s French embassy, where you will be able to pick it up. Following is the information necessary to obtain your diploma in that way, with an example:

   Civility : Mr ADAM Hassane Deye born January 17, 1980 in N’DJAMENA (Tchad)
   Student number : N° 16G753Q
   Address as detailed as possible, with ZIP code, state, and so on : Quartier Bololo, Avenue Joseph Brahim Séïd N’DJAMENA TCHAD
   Email : adamhassanedeye@yahoo.fr **Telephone** (including country code): (+235) 66248226 / (+235) 99941404
3. It is also always possible to obtain your final DUG diploma through power of attorney using a proxy who can get it in Nantes in your place. In order to do this, your proxy must be able to produce a hand-written letter from you, hand signed, asking for the diploma, together with a photocopy of the proxy’s valid ID.

The person in charge of managing final paper diplomas at the moment (2023) is :

Denis BOUISSOU
Service de la Scolarité, Faculté des Sciences et des Techniques
Campus Lombarderie - Site de Nantes | 2, rue de la Houssinière - BP 92208 - 44322 Nantes Cedex
Tel : +33 2 51 12 52 44 | E-mail: Denis.Bouissou@univ-nantes.fr

403
apprenants

150
diplômés

Association anciens étudiants
Centre de Recherche Gemmologique (CRG)
crg-dug.fr

Association internationale qui valorise et promeut la gemmologie francophone
gemmologie-francophonie.com

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