

UP - 000	Intensive course in French	UP	Elective	30h	ECTS : 0
Contents		Evaluation		Horary	
Intensive training in French language using a variety of multimedia tools and open conversation in groups			written exam		lecture
		50%	oral exam		seminary
		50%	exercices	30	practice
			project		
<i>Teaching staff : CFLE-UP (Centre Français Langue Etrangère)</i>			report		<i>Teaching</i>
			presentation	FR	P0 Y1
UP - 001	Field trip	UP	Compulsory	28h	ECTS : 3
Contents		Evaluation		Horary	
Field trip			written exam	8	lecture
			oral exam		seminary
			exercices	20	practice
			project		
<i>Teaching staff : UP staff</i>		100%	report		<i>Teaching</i>
			presentation	EN, FR	P0 Y1
UP - 002	Basic knowledge update	UP	Compulsory	28h	ECTS : 3
Contents		Evaluation		Horary	
Basic knowledge update in Mathematics, Physics, Chemistry, Earth Sciences			written exam	14	lecture
			oral exam		seminary
		100%	exercices	14	practice
			project		
<i>Teaching staff : UP</i>			Report		<i>Teaching</i>
			presentation	EN, FR	P0 Y1
UP - 100	Language training in English, Portuguese or French	UP	Compulsory	40h	ECTS : 3
Contents		Evaluation		Horary	
Weakly language training			written exam		lecture
		50%	oral exam		seminary
		50%	exercices	40	practice
			project		
<i>Teaching staff : UP - UFR Lettres et Langues, Centre de Langue Portugaise, Département d'Etude de la Langue Portugaise et Brésilienne, CFLE-UP (Centre Français Langue Etrangère)</i>			report		<i>Teaching</i>
			presentation	FR, PT, EN	P1 Y1
UP - 101	Crystal structure and organisation of finely divided solids	UP	Compulsory	56h	ECTS : 6
Contents		Evaluation		Horary	
Crystal chemistry of phyllosilicates and other lamellar structures: basics. Physical principles of interactions between a particle beam and solids. Theoretical basis of diffractions (X-rays, electrons and neutrons) and common uses. Structural characterisation of lamellar structures. Practical : common uses of X-ray diffraction, practical specific to lamellar systems. Quantitative phase analyses using X-ray diffraction		50%	written exam	28	lecture
			oral exam		seminary
		50%	exercices	28	practice
			project		
<i>Teaching staff : E. Ferrage (UP), A. Meunier (UP) and external contributors: B. Lanson, R. Kleeberg</i>			Report		<i>Teaching</i>
			presentation	EN, FR	P1 Y1

UP - 102	Crystal chemistry and local structure of clays	UP	Compulsory	56h	ECTS : 6
Contents		Evaluation		Horary	
chemistry of iron phases. Thermal analyses Examples of integrated studies		50%	written exam	28	lecture
			oral exam		seminary
		50%	exercices	28	practice
			project		
<i>Teaching staff : S. Petit (UP) and external contributors</i>			Report		<i>Teaching</i>
			presentation	EN, FR	P1 Y1
UP - 103	Crystal growth and mineralogenesis of clays	UP	Compulsory	56h	ECTS : 6
Contents		Evaluation		Horary	
Fundamentals of crystal growth, equilibria and disequilibria in multicomponents systems : the equilibria shape of crystals ; growth kinetics ; free crystal growth ; collective behaviour of crystals. The case of clays : inferences for anisotropic crystals ; dissolution/recrystallisation, replacement in the solid state; order/disorder in the layer stacking Clay synthesis from solutions and from gels		50%	written exam	28	lecture
			oral exam		seminary
		50%	exercices	28	practice
			project		
			Report		<i>Teaching</i>
			presentation	EN, FR	P1 Y1

<i>Teaching staff : S. Petit (UP) and external contributors : A Baronnet and others</i>					
UP - 104	Thermodynamic data for clay minerals	UP	Compulsory	28h	ECTS : 3
Contents		Evaluation		Horary	
Fundamental principles, reference state mass-action expression, solubility, stability and aqueous species diagrams, thermodynamic database. Experimental measurements of thermodynamic constants; calorimetry and aqueous phase equilibrium. Methods of prediction applied to thermodynamic properties of clay minerals : enthalpy, Gibbs free energy, entropy and heat capacity		50%	written exam	14	lecture
			oral exam		seminary
		50%	exercises	14	practice
			project		
<i>Teaching staff : P. VIEILLARD (UP) and external contributors: P. Blanc and others</i>			Report	<i>Teaching</i>	
			presentation	<i>EN, FR</i>	P1 Y1
UP - 105	Molecular modelling	UP	Compulsory	28h	ECTS : 3
Contents		Evaluation		Horary	
General interest and importance of molecular modelling for the study of matter. Basic principles of statistical mechanics Levels of modelling (ab-initio, classical atomic, mesoscopic). Details on Monte Carlo and Molecular Dynamics Simulation of type MC and MD for the study of clays joining simulation and experiment		50%	written exam	14	lecture
			oral exam		seminary
		50%	exercises	14	practice
			project		
<i>Teaching staff : external contributors : V. Marry and others</i>			Report	<i>Teaching</i>	
			presentation	<i>EN, FR</i>	P1 Y1
UP - 106	Physical chemistry and hydromechanics : Microstructure and physical properties	UP	Compulsory	56h	ECTS : 6
Contents		Evaluation		Horary	
and quantitative analyses). Textural analyses : gaz adsorption and mercury porosimetry. Microstructure and hydromechanical properties : swelling, homogenisation			written exam	21	lecture
			oral exam		seminary
		50%	exercises	35	practice
			project		
<i>Teaching staff : D. Prêt (UP) + external contributors : F. Villieras and others</i>			Report	<i>Teaching</i>	
			presentation	<i>EN, FR</i>	P1 Y1
UP - 107	Physical chemistry and hydromechanics : Solid-solution interface	UP	Compulsory	56h	ECTS : 6
Contents		Evaluation		Horary	
adsorption of organic molecules. Hydration : crystalline and osmotic swellings. Colloidal behaviour : aggregation, rheology		50%	written exam	18	lecture
			oral exam		seminary
		50%	exercises	38	practice
			project		
<i>Teaching staff : E. Tertre (UP) + external contributors : F. Thomas and others</i>			Report	<i>Teaching</i>	
			presentation	<i>EN, FR</i>	P1 Y1
UP - 108	Bibliographical project	UP	Compulsory	20h	ECTS : 3
Contents		Evaluation		Horary	
Bibliographical research work on a subject dealing with clay chosen by the student			written exam		lecture
			oral exam		seminary
			exercises	20	practice
			project		
<i>Teaching staff : UP</i>			Report	<i>Teaching</i>	
		100%	presentation	<i>EN, FR</i>	P1 Y1
TUC - 200	Language training in Greek	TUC	Elective	30h	ECTS : 0
Contents		Evaluation		Horary	
Weakly language training			written exam		lecture
			oral exam		seminary
		100%	exercises	30	practice
			project		
<i>Teaching staff : External contributor</i>			report	<i>Teaching</i>	
			presentation	<i>GR</i>	P2 Y1
TUC - 201	Professional practice and research project	TUC	Compulsory	400h	ECTS : 12

Contents		Evaluation	Horary	
This module offers the possibility to the student to deal with a specific applied domain in a given time period. The objective is to provide the student with a professional experience and to give him the opportunity of getting integrated into a professional team.		written exam		lecture
		oral exam		seminary
	75%	exercises	400	practice
		project		
	Teaching staff : TUC	25%	Report	Teaching
		presentation		P2 Y1
UA - 210 Language training in Portuguese UA Elective 60h ECTS : 0				
Contents		Evaluation	Horary	
Weakly language training		written exam		lecture
		oral exam		seminary
	100%	exercises	60	practice
		project		
	Teaching staff :		report	Teaching
		presentation	PT	P2 Y1
UA - 211 Professional practice and research project UA Compulsory 400h ECTS : 12				
Contents		Evaluation	Horary	
This module offers the possibility to the student to deal with a specific applied domain in a given time period. The objective is to provide the student with a professional experience and to give him the opportunity of getting integrated into a professional team.		written exam		lecture
		oral exam		seminary
		exercises	400	practice
		project		
	Teaching staff : UA	75%	Report	Teaching
	25%	presentation		P2 Y1

UFRGS - 220 Language training in Portuguese		UFRGS	Elective	30h	ECTS : 0
Contents		Evaluation	Horary		
Weakly language training		written exam		lecture	
		oral exam		seminary	
	100%	exercises	30	practice	
		project			
	Teaching staff :		report	Teaching	
		presentation	PT	P2 Y1	
UFRGS - 221 Professional practice and research project UFRGS Compulsory 400h ECTS : 12					
Contents		Evaluation	Horary		
This module offers the possibility to the student to deal with a specific applied domain in a given time period. The objective is to provide the student with a professional experience and to give him the opportunity of getting integrated into a professional team.		written exam		lecture	
		oral exam		seminary	
		exercises	400	practice	
		project			
	Teaching staff : UFRGS	75%	Report	Teaching	
	25%	presentation		P2 Y1	
UO - 230 Language training in French or English UO Elective 56h ECTS : 0					
Contents		Evaluation	Horary		
Weakly language training		written exam		lecture	
		oral exam		seminary	
	50%	exercises	56	practice	
		project			
	Teaching staff :		report	Teaching	
		presentation	FR, EN	P2 Y1	
UO - 231 Professional practice and research project UO Compulsory 400h ECTS : 12					
Contents		Evaluation	Horary		
This module offers the possibility to the student to deal with a specific applied domain in a given time period. The objective is to provide the student with a professional experience and to give him the opportunity of getting integrated into a professional team.		written exam		lecture	
		oral exam		seminary	
		exercises	400	practice	
		project			
	Teaching staff : UFRGS	75%	Report	Teaching	
	25%	presentation		P2 Y1	
TUC - 300 Language training in Greek TUC Elective 30h ECTS : 0					
Contents		Evaluation	Horary		
Weakly language training		written exam		lecture	
		oral exam		seminary	
	100%	exercises	30	practice	
		project			

Teaching staff : External contributor	report	Teaching		
	presentation	GR	P3 Y2	
TUC - 301 Industrial clay deposits	TUC	Compulsory	56h	ECTS : 6
Contents	Evaluation	Horary		
Bentonites, kaolins, palygorskite and sepiolite, common clays. Geological characteristics of industrial clay deposits. Important physical properties of industrial clays (cation exchange capacity, plasticity, viscosity, colour, specific surface area, porosity, particle size distribution). Techniques for characterisation of industrial clays (mineralogy, chemistry, physical and chemical properties, thermal techniques). Assessment routes of industrial clay deposits.	50%	written exam	24	lecture
		oral exam	8	seminary
	25%	exercises	24	practice
	25%	project		
		Report	Teaching	
	presentation	EN	P3 Y2	
Teaching staff : external contributors : G.E. Christidis (TUC), P. Makri (TUC) + external collaborators				

Clays for geotechnical and civil engineering applications				
TUC - 302	TUC	Compulsory	42h	ECTS : 4.5
Contents	Evaluation	Horary		
Classification of soils, grain size analysis, swelling of clays, hydraulic conductivity of clays, plasticity of clays, consolidation tests, unconfined compression testing, direct shear tests.	50%	written exam	16	lecture
		oral exam	8	seminary
	25%	exercises	18	practice
	25%	project		
		Report	Teaching	
Teaching staff :E. Steiakakis (TUC) + external collaborators	presentation	EN	P3 Y2	
Processing routes for layer silicates and associated minerals				
TUC - 303	TUC	Compulsory	42h	ECTS : 4.5
Contents	Evaluation	Horary		
Processing of layer silicates and associated minerals (classification, froth flotation, magnetic separation, electrostatic separation, density separation), removal of clay gangue from mineral deposits, mass balance and evaluation of beneficiation routes for industrial clays, process design and simulation.	50%	written exam	16	lecture
		oral exam	8	seminary
	25%	exercises	18	practice
	25%	project		
		Report	Teaching	
Teaching staff :E. Stamboliadis (TUC) + E. Petrakis (TUC) + O. Pantelaki (TUC) + external collaborators	presentation	EN	P3 Y2	
Field trip to industrial clay deposits (4 days)				
TUC - 304	TUC	Elective	28h	ECTS : 3
Contents	Evaluation	Horary		
Visit to industrial clay deposits in Milos Island (bentonites, kaolins and zeolites) or in Grevena area (palygorskite-smectite)		written exam		lecture
		oral exam		seminary
	100%	exercises	28	practice
		project		
		report	Teaching	
Teaching staff : G.E. Christidis (TUC)+ E. Stamboliadis (TUC) + external collaborators from industry	presentation	EN	P3 Y2	
Language training in French or English				
UO - 310	UO	Elective	56h	ECTS : 0
Contents	Evaluation	Horary		
Weakly language training		written exam		lecture
	50%	oral exam		seminary
	50%	exercises	56	practice
		project		
		report	Teaching	
Teaching staff :	presentation	EN, FR	P3 Y2	
Seminar				
UO - 311	UO	Elective	28h	ECTS : 3
Contents	Evaluation	Horary		
Presentation of a seminar and attending a series of seminars. Techniques and skills of scientific presentations		written exam		lecture
		oral exam	14	seminary
		exercises	14	practice
		project		
		report	Teaching	
Teaching staff : Department of Chemistry (Ottawa)	100%	presentation	EN, FR	P3 Y2
Clay minerals chemistry				
UO - 312	UO	Elective	56h	ECTS : 6
Contents	Evaluation	Horary		
Mineralogy and structure of clay minerals. Hybrid clay materials,	60%	written exam	20	lecture

advanced clay for catalysis applications, Inorganic structure-clay nanocomposites, polymer-clay and polymer-HDL nanocomposites, new trends in research of advanced clay materials		oral exam	10	seminary
	15%	exercises	26	practice
<i>Teaching staff</i> : C. Detellier (UO; Chemistry); A. Lalonde (UO, Earth Science) + external contributors		project		
	25%	report		<i>Teaching</i>
		presentation	EN, FR	P3 Y2

UO - 313	Surface chemistry of clay minerals	UO	Elective	56h	ECTS : 6
Contents		Evaluation		Horary	
Characterization techniques of clay minerals and clay-based advanced materials, with hands-on applications, including electron microscopy (SEM, HRTEM); XPS; Microporosimetry; TG-MS; FTIR; Solid-State NMR			written exam		lecture
			oral exam		seminary
<i>Teaching staff</i> : C. Detellier(UO); Y. Liu; S. Mommers; S. Letaief (Center for Research and Innovation in Catalysis; UO)		100%	exercises	56	practice
			project		
			report		<i>Teaching</i>
			presentation	EN, FR	P3 Y2

UO - 314	Surface chemistry of clay minerals	UO	Elective	28	ECTS : 3
Contents		Evaluation		Horary	
Basic computational and simulation methods. Particular emphasis on solid state calculation and extended solid structures, such as clay minerals		75%	written exam	14	lecture
			oral exam		seminary
<i>Teaching staff</i> : S. Gorelski (UO)		25%	exercises	14	practice
			project		
			report		<i>Teaching</i>
			presentation	EN, FR	P3 Y2

UP - 401	Geological systems : clays in the Earth's crust	UP	Elective	56h	ECTS : 6
Contents		Evaluation		Horary	
Origin and evolution of clays in oceanic environment : detrital hydrothermal and authigenic clays. Continental clays : weathering in tropical zones, clays in fossil hydrothermal systems and active geothermal fields, evolution of clays during diagenesis of silicoclastic sediments		50%	written exam	28	lecture
			oral exam		seminary
<i>Teaching staff</i> : D. Beaufort (UP) , P. Patrier (UP) + A. El Albani + external contributors			exercises	28	practice
			project		
			report		<i>Teaching</i>
		50%	presentation	EN, FR	P4 Y2

UP - 402	Fluid clays interaction modelling in the environment	UP	Elective	28h	ECTS : 3
Contents		Evaluation		Horary	
Thermodynamic modelling of fluid-clays interactions. Kinetic modelling of the precipitation of clay minerals (1) with fixed composition, (2) with variable composition. From experiments to modelling on Al-Mg layer silicates		50%	written exam	14	lecture
			oral exam		seminary
<i>Teaching staff</i> : external contributors: B. Fritz...			exercises	14	practice
			project		
		50%	report		<i>Teaching</i>
			presentation	EN, FR	P4 Y2

UP - 403	The critical zone	UP	Elective	56h	ECTS : 6
Contents		Evaluation		Horary	
Role of biota in clay genesis. Microorganism/clay interactions.Plant/clay interactions		50%	written exam	28	lecture
			oral exam		seminary
Oxido-reduction and lamellar structures. Speciation of metals in soil. Field investigations			exercises	28	practice
			project		
<i>Teaching staff</i> : L. Caner + external contributors			report		<i>Teaching</i>
		50%	presentation	EN, FR	P4 Y2

UP - 404	Field trip	UP	Elective	28h	ECTS : 3
Contents		Evaluation		Horary	
Visit of historical and famous regional clay sites (Montmorillon, Nontron...)			written exam		lecture
			oral exam		seminary
<i>Teaching staff</i> : A. Meunier, P. Patrier, A. El Albani (UP) + external contributors			exercises	28	practice
			project		
		100%	report		<i>Teaching</i>
			presentation	EN, FR	P4 Y2

UA - 410	Language training in Portuguese	UA	Elective	36	ECTS : 0
Contents		Evaluation		Horary	

Weakly language training		written exam	lecture
		oral exam	seminary
	100%	exercises	36 practice
		project	
		report	<i>Teaching</i>
<i>Teaching staff :</i>		presentation	<i>PT P4 Y2</i>

UA - 411	Interaction clays and biological systems	UA	Elective	56h	ECTS : 6
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Contents	Evaluation	Horary	
Mineralogical and environmental bases. Basics in physiology and cell biology-biochemistry. Basics in chemistry and biochemistry Bio-adhesivity; bio-activity, bacteriological studies, microflora characterization, and evaluation of anti-inflammatory action. Photosynthetic activity measured by Pulse Amplitude Modulated fluorometry. Detection of SGLs by HPTLC, quantified by Azure A colorimetric method and chemically characterized by MS Bacteria identification by DGGE.	50%	written exam	28 lecture
		oral exam	seminary
	50%	exercises	28 practice
		project	
		Report	<i>Teaching</i>
<i>Teaching staff : F. Rocha (UA) , E. Silva (UA) + external contributors</i>		presentation	<i>EN, PT P4 Y2</i>

UA - 412	Healing minerals : Identification and characterisation, advanced clay for health	UA	Elective	56h	ECTS : 6
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Contents	Evaluation	Horary	
Mineralogical composition (XRD, SEM) Chemical composition (XRF, AAS, SEM-EDAX) Grain size distribution by X-ray absorption (Sedigraph) Maturation. Certification and normalization. Quality control. Prototype maturation plant. Microalgae development during maturation and physiologic effect of thermal muds	50%	written exam	28 lecture
		oral exam	seminary
	50%	exercises	28 practice
		project	
		Report	<i>Teaching</i>
<i>Teaching staff : F. Rocha (UA) , E. Silva (UA) + external contributors</i>		presentation	<i>EN, PT P4 Y2</i>

UA - 413	Healing minerals : industrial aspects	UA	Elective	56h	ECTS : 6
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Contents	Evaluation	Horary	
Relevant clay technological properties: pH, specific surface area, ion exchange capacity and exchangeable ions, adsorption and absorption, liquid and plastic limits – plasticity index, expandability, adherence limit, abrasivity, cooling rate, specific heat, heat diffusiveness, soluble salts, water retention. Visit of healing clay sites (Meco, Consolação...)	25%	written exam	14 lecture
		oral exam	seminary
	25%	exercises	42 practice
		project	
		Report	<i>Teaching</i>
<i>Teaching staff : F. Rocha (UA) , E. Silva (UA) + C. Patinha (UA) , P. Marinho (UA) + external contributors</i>		presentation	<i>EN, PT P4 Y2</i>

UP - 501	Master Thesis	UP	Elective	600h	ECTS : 24
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Contents	Evaluation	Horary	
Each student should develop and present an original and innovative research project under the supervision (or co-supervision) of a staff member of the UP.		written exam	lecture
		oral exam	seminary
		exercises	600 practice
		project	
		75% report	<i>Teaching</i>
<i>Teaching staff :</i>	25%	presentation	P5 Y2

TUC - 511	Master Thesis	TUC	Elective	600h	ECTS : 24
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Contents	Evaluation	Horary	
Each student should develop and present an original and innovative research project under the supervision (or co-supervision) of a staff member of the TUC.		written exam	lecture
		oral exam	seminary
		exercises	600 practice
		project	
		75% report	<i>Teaching</i>
<i>Teaching staff :</i>	25%	presentation	P5 Y2

UA - 521	Master Thesis	UA	Elective	600h	ECTS : 24	
Contents		Evaluation		Horary		
Each student should develop and present an original and innovative research project under the supervision (or co-supervision) of a staff member of the UA.		written exam		lecture		
		oral exam		seminary		
		exercises		600	practice	
		project				
		75%	report	<i>Teaching</i>		
<i>Teaching staff :</i>		25%	presentation	P5 Y2		
UFRGS - 530	Language training in Portuguese	UFRGS	Elective	60h	ECTS : 0	
Contents		Evaluation		Horary		
Weakly language training		written exam		lecture		
		oral exam		seminary		
		100%	exercises	60	practice	
		project				
		report		<i>Teaching</i>		
<i>Teaching staff :</i>		presentation		<i>PT</i>	P5 Y2	
UFRGS - 531	Master Thesis	UFRGS	Elective	390h	ECTS : 19	
Contents		Evaluation		Horary		
Each student should develop and present an original and innovative research project under the supervision (or co-supervision) of a staff member of the UFRGS.		written exam		lecture		
		oral exam		seminary		
		exercises		390	practice	
		project				
		75%	report	<i>Teaching</i>		
<i>Teaching staff :</i>		25%	presentation	P5 Y2		
UFRGS - 532	Hydrothermal Alteration and Metallogeny	UFRGS	Elective	60h	ECTS : 3	
Contents		Evaluation		Horary		
Presentation of methodologies for field and laboratory for the understanding of hydrothermal processes in association with the occurrence of clay minerals. X-ray diffraction, chemical microanalysis; sampling and description of the survey evidence, chemical analysis (geochemical mass balance). Applications to ore deposits.		written exam		40	lecture	
		oral exam		seminary		
		50%	exercises	20	practice	
		project				
		25%	report	<i>Teaching</i>		
<i>Teaching staff : Andre S. Mexias (UFRGS); Márcia E.B. Gomes (UFRGS) + external collaborators.</i>		25%	presentation	<i>EN, PT</i>	P5 Y2	

UFRGS - 533	Geology of Clay and Clay Minerals Deposits in Brazil	UFRGS	Elective	90h	ECTS : 5	
Contents		Evaluation		Horary		
Clay Minerals associated to giant amethyst deposits in basalts floods. Clays in Au, Cu and base metals deposits (epithermal environments). Bentonites in gondwana sedimentary rocks. Supergene and lateritic deposits associated to kaolins (amazonic region).		written exam		30	lecture	
		oral exam		seminary		
		50%	exercises	60	practice	
		project				
		25%	report	<i>Teaching</i>		
<i>Teaching staff : Márcia E.B. Gomes (UFRGS); Andre S. Mexias (UFRGS); Norberto Dani (UFRGS) + external collaborators.</i>		25%	presentation	<i>EN, PT</i>	P5 Y2	
UO - 541	Master Thesis	UO	Elective	600h	ECTS : 24	
Contents		Evaluation		Horary		
Each student should develop and present an original and innovative research project under the supervision (or co-supervision) of a staff member of the UO.		written exam		lecture		
		oral exam		seminary		
		exercises		600	practice	
		project				
		75%	report	<i>Teaching</i>		
<i>Teaching staff :</i>		25%	presentation	P5 Y2		