Module Handbook

Program:

“Chemical and Metallurgical Processes”

(Lima)

July, 2014
Lima-Arequipa
Perú

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Modules and Courses

ID	Module	Courses	Semester	ECTS Credits	
QM-01	Chemical Fundamentals	Chemistry	1	4	13
		Inorganic Chemistry	2	6	
		Organic Chemistry	3	3	
QM-02	Thermodynamics	Thermodynamics	3	4	8
		Physical Chemistry	3	4	
QM-03	Mineral Processing	General Metallurgy	3	3	15
		Mineral Processing I	3	6	
		Mineral Processing II	4	6	
QM-04	Analytical Chemistry	Analytical Chemistry I	4	6	15
		Analytical Chemistry II	5	5	
		Environmental Analytical Chemistry	6	4	
QM-05	Industrial Technology Processes	Industrial Chemistry I	5	4	8
		Industrial Chemistry II	6	4	
QM-06	Applied Technology	Environmental Engineering	6	5	8
		Industrial Control and Automation	5	3	
QM-07	Industrial Operations	Industrial Operations I	5	4	8
		Industrial Operations II	6	4	
QM-08	Chemical Processes	Chemical Processes	4	5	7
		Food Industries	4	2	
QM-09	Metallurgical Processes	Metallurgical Processes I	5	4	8
		Metallurgical Processes II	6	4	
QM-10	Applied Mathematics	Applied Mathematics	3	5	9
		Statistics Applied to Laboratories	4	4	
QM-11	Fundamental Technology	Electromechanical Workshop	1	3	6
		Technical Drawing	2	3	
QM-12	**Mathematics**	Mathematics I	1	6	12
		Mathematics II	2	6	
QM-13	**Physics**	Physics I	1	5	10
		Physics II	2	5	
QM-14	**Fundamentals of Electrical Technology**	Electricity	1	5	10
		Electronics	2	5	
QM-15	**Values and Culture**	Attitudes and Values	1	2	4

ID	Module	Courses	Semester	ECTS Credits	
		National and International Reality	2	2	
QM-16	Communications	Communication I	1	4	10
		Communication II	2	4	
		Successful Presentations	3	2	
QM-17	Quality and Safety	Continuous Improvement	3	2	5
		Safety, Health and Environment	4	3	
QM-18	Basic English	English I	5	4	8
		English II	6	4	
QM-19	Management	Maintenance Management	4	3	9
		Project Management	5	3	
		Business Management	6	3	
QM-20	Human Resources and Labor Market	Decisions Making	4	2	7
		Human Resources Management	5	3	
		Induction to Labor Market	6	2	
			Σ =	180	180

Chemical Fundamentals Module

<table>
<tr><td>Degree Program</td><td colspan="4">Chemical and Metallurgical Processes</td></tr>
<tr><td>Module designation</td><td colspan="4">Chemical Fundamentals</td></tr>
<tr><td>Module level, if applicable</td><td colspan="4"></td></tr>
<tr><td>Code, if applicable</td><td colspan="4">QM-01</td></tr>
<tr><td rowspan="4">Courses and Semester(s) in which the module is taught</td><td colspan="2">Courses</td><td>ID</td><td>Semester</td></tr>
<tr><td colspan="2">- Chemistry</td><td>QQ1010</td><td>1</td></tr>
<tr><td colspan="2">- Inorganic Chemistry</td><td>QQ2810</td><td>2</td></tr>
<tr><td colspan="2">- Organic Chemistry</td><td>QQ3010</td><td>3</td></tr>
<tr><td>Person responsible for the Module</td><td colspan="4">- Laurence Salmon</td></tr>
<tr><td>Lecturers</td><td colspan="4">- Laurence Salmon
- Hernán Zapata
- José Flores</td></tr>
<tr><td>Language</td><td colspan="4">Spanish</td></tr>
<tr><td>Relation to curriculum</td><td colspan="4">Compulsory</td></tr>
<tr><td>Type of teaching, contact hours</td><td colspan="4">Contact hours and class size separately for each teaching method: lecture, lesson, practical, project, seminar, etc.
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<tr><th>Nr</th><th>Courses ID</th><th>Contact hours per week</th><th>Teaching Method</th><th>Class Size</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">QQ1010</td><td>2.0</td><td>Lecture</td><td>40 students</td></tr>
<tr><td>1.5</td><td>Laboratory</td><td>20 students</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">QQ2810</td><td>3.0</td><td>Lecture</td><td>40 students</td></tr>
<tr><td>4.0</td><td>Laboratory</td><td>20 students</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">QQ3010</td><td>2.0</td><td>Lecture</td><td>40 students</td></tr>
<tr><td>2.0</td><td>Laboratory</td><td>20 students</td></tr>
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<tr><td>Workload</td><td colspan="4">(Estimated) workload, divided into contact hours (lecture, exercise, laboratory session, etc.) and private study, including examination preparation, specified in hours.
<table>
<tr><th>Nr</th><th>Courses</th><th>Contact Hours per week</th><th>Private Study per week</th><th>Total Workload</th><th>ECTS Credits</th></tr>
<tr><td>1</td><td>QG1010</td><td>3.5</td><td>3.4</td><td>124</td><td>4</td></tr>
<tr><td>2</td><td>QQ2810</td><td>7.0</td><td>3.0</td><td>180</td><td>6</td></tr>
<tr><td>3</td><td>QQ3010</td><td>4.0</td><td>1.8</td><td>104</td><td>3</td></tr>
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<tr><td>Requirements according to the examination regulations</td><td colspan="4">In order to pass each course of the module, student must obtain a minimal final grade of 11 (eleven). To compute the final grade, the fraction 0.5 or more is considered as a unit in favor the student. (Exam. Reg. 2013 Art. 21)</td></tr>
<tr><td>Recommended prerequisites</td><td colspan="4">Formal: None
Content: Materials and Mathematics knowledge, and computing skill</td></tr>
<tr><td>Module objectives/intended learning outcomes</td><td colspan="4">After having finished the module, students are able to:
Knowledge:
- Discover the structure and properties of matter and types of links in nature inorganic and organic substances.
- Interpret the chemical reactions and the stoichiometric fundamental knowledge.
- Interpret the fundamentals of balance reactions and their applications.
Skills:
- Design chemical equations and apply stoichiometry in organic and inorganic chemical reactions.
- Assess the feasibility of a chemical reaction in organic and inorganic substances
- Identify the main organic compounds and inorganic cations by means of qualitative analysis</td></tr>
</table>

	Competences: - *Predict by different methodologies both inorganic and organic chemical reactions* - *Evaluate the properties of natural and synthetic, and combustible materials* - *Carry out a task with quality and safety in the chemical laboratory with the commitment to the protection of the environment.*
Content	***Chemistry**: The matter. States of the matter's aggregation. The atom. Elements of periodic table. Link chemist - types of chemical bonds and Intermolecular forces. Chemistry Reaction. Stoichiometry. Acidity and basicity Solutions. Electrochemistry and its applications. Industrial Chemical Processes - inorganic and organic compounds.* ***Inorganic Chemistry:** Chemical equilibrium/balance. Acid – base Balance. Solubility equilibrium. Balance of coordination. Redox equilibrium. Identification of cations.* ***Organic Chemistry**: Chemical bond - Atomic orbitals. Orbitals molecular; Nomenclature of hydrocarbons; Nomenclature of organic compounds oxygenated and nitrogen. Reactions of alkanes, alkenes. Alcohols. Benzene and electrophilic aromatic substitution. Amines: properties and reactivity. Polymerization; Aldehydes and ketones. Carbohydrates, reactions. Amino acids, proteins. And lipids.*
Study and examination requirements and forms of examination	*Laboratory: preparations with review, lab reports* *Lecture: partial written tests and final written exam*
Media employed	*Blackboard, slides, beamer presentations, demonstration of lab examples and experiments, lab development tools and equipment*
Reading list	- *Chang, Raymond (2002) Química. México D.F.: McGraw-Hill (540/CH518/2007)* - *Petrucci, Ralph H. (2003) Química General. Madrid: Pearson Education (540/P48)* - *Ebbing, Darrell (1997) Química General. México D.F.: McGraw-Hill. (540/E11).* - *Gillespie, Ronald (1989) Chemistry. Boston: Allyn and Bacon (540/G39).* - *Malone, Leo (1992) Introducción a la química. México D.F.: Limusa (540/M19).* - *Brewster, Ray Q. (1978) Curso de química orgánica experimental. Barcelona: Alhambra S.A. (547/B82)* - *Domínguez, Jorge Alejandro (1984) Fundamentos y problemas de química orgánica. México D.F.: Limusa. (547/D88)* - *Primo Yufera, Eduardo (2006) Química orgánica básica y aplicada. Tomos 1 y 2. Barcelona: Reverté. (547/P86/t.1 y t.2)*

Thermodynamics Module

<table>
<tr><td>Degree Program</td><td colspan="5">Chemical and Metallurgical Processes</td></tr>
<tr><td>Module designation</td><td colspan="5">Thermodynamics</td></tr>
<tr><td>Module level, if applicable</td><td colspan="5"></td></tr>
<tr><td>Code, if applicable</td><td colspan="5">QM-02</td></tr>
<tr><td rowspan="3">Courses and Semester(s) in which the module is taught</td><td colspan="3">Courses</td><td>ID</td><td>Semester</td></tr>
<tr><td colspan="3">- Thermodynamics</td><td>QQ3070</td><td>3</td></tr>
<tr><td colspan="3">- Physical Chemistry</td><td>QQ3050</td><td>3</td></tr>
<tr><td>Person responsible for the Module</td><td colspan="5">- Ulises Quiroz</td></tr>
<tr><td>Lecturer</td><td colspan="5">- Ulises Quiroz</td></tr>
<tr><td>Language</td><td colspan="5">Spanish</td></tr>
<tr><td>Relation to curriculum</td><td colspan="5">Compulsory</td></tr>
<tr><td>Type of teaching, contact hours</td><td colspan="5">Contact hours and class size separately for each teaching method: lecture, lesson, practical, project, seminar, etc.
<table>
<tr><th>Nr</th><th>Courses ID</th><th>Contact hours per week</th><th>Teaching Method</th><th>Class Size</th></tr>
<tr><td>1</td><td>QQ3070</td><td>2.0</td><td>Lecture</td><td>40 students</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">QQ3050</td><td>2.0</td><td>Lecture</td><td>40 students</td></tr>
<tr><td>2.0</td><td>Laboratory</td><td>20 students</td></tr>
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<tr><td>Workload</td><td colspan="5">(Estimated) workload, divided into contact hours (lecture, exercise, laboratory session, etc.) and private study, including examination preparation, specified in hours.
<table>
<tr><th>Nr</th><th>Courses</th><th>Contact Hours per week</th><th>Private Study per week</th><th>Total Workload</th><th>ECTS Credits</th></tr>
<tr><td>1</td><td>QQ3070</td><td>2.0</td><td>3.9</td><td>106</td><td>4</td></tr>
<tr><td>2</td><td>QQ3050</td><td>4.0</td><td>2.5</td><td>117</td><td>4</td></tr>
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<tr><td>Requirements according to the examination regulations</td><td colspan="5">In order to pass each course of the module, student must obtain a minimal final grade of 11 (eleven). To compute the final grade, the fraction 0.5 or more is considered as a unit in favor the student. (Exam. Reg. 2013 Art. 21)</td></tr>
<tr><td>Recommended prerequisites</td><td colspan="5">Formal: None
Content: Chemical and Mathematics knowledge, and computing skill</td></tr>
<tr><td>Module objectives/intended learning outcomes</td><td colspan="5">After having finished the module, students are able to:
Knowledge:
- Identify the laws that govern the behavior of real gases and their applications.
- Apply concepts on chemical reactions kinetics.
Skills:
- Identify and analyze thermodynamics systems employed in metallurgical and chemical processes.
- Analyze the spontaneity of a chemical reaction
Competences:
- Interpret and apply thermodynamic principles on metallurgical and chemical processes to solve problematic situations by characterizing the behavior of gases and liquids.
- Analyze the thermodynamic possibility of chemical reactions in order to accomplish the objectives by applying concepts on solutions and ideal gases in industrial level</td></tr>
<tr><td>Content</td><td colspan="5">Thermodynamics: States and State functions; Zero Principle of thermodynamics;. First law of thermodynamics - Adiabatic processes - Thermochemistry; Second law of thermodynamics - free energy and chemical equilibrium - Thermodynamics of air - heat transmission; Third law of thermodynamics.

Physical Chemistry. The first thermodynamic principle applied to chemical reactions; Nature and laws of the Gases. Ideals; Properties of real Gases; Ideal and non-ideal solutions - conductance in electrolytes; The rule of stages - equilibrium in two phase component systems; Chemistry of surfaces; chemical Kinetic - reaction mechanisms; Galvanic cells - electrolytic cells.</td></tr>
</table>

Study and examination requirements and forms of examination	*Laboratory: preparations with review, lab reports* *Lecture: partial written tests and final written exam*
Media employed	*Blackboard, slides, beamer presentations, demonstration of lab examples and experiments, lab development tools and equipment.*
Reading list	- *Levenspiel, Octave (2000) Fundamentos de termodinámica. México D.F.: Prentice Hall (536.7/L54)* - *Pérez Cárdenas, Salvador (1990) Fundamentos de termodinámica. México D.F.: Limusa (536.7/P45).* - *Smith, J.M. (2005) Introducción a la termodinámica en ingeniería química. México D.F.: McGraw-Hill (536.7/S61)* - *Bartow, Gordon M. (1988). Química física. Barcelona: Reverté (541.3/B23Q)* - *Castellan, Gilbert W. (1987). Físicoquímica. Buenos Aires: ALVI (541.3/C28)* - *Pons Muzzo, Gastón (1985). Tratado de química física. Lima: s.n. (541.3/P77)*

Mineral Processing Module

<table>
<tr><td>Degree Program</td><td colspan="5">Chemical and Metallurgical Processes</td></tr>
<tr><td>Module designation</td><td colspan="5">Mineral Processing</td></tr>
<tr><td>Module level, if applicable</td><td colspan="5"></td></tr>
<tr><td>Code, if applicable</td><td colspan="5">QM-03</td></tr>
<tr><td>Courses and Semester(s) in which the module is taught</td><td colspan="5">
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<tr><th>Courses</th><th>ID</th><th>Semester</th></tr>
<tr><td>- General Metallurgy</td><td>QQ3100</td><td>3</td></tr>
<tr><td>- Mineral Processing I</td><td>QQ3030</td><td>3</td></tr>
<tr><td>- Mineral Processing II</td><td>QQ4050</td><td>4</td></tr>
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<tr><td>Person responsible for the Module</td><td colspan="5">- Teobaldo Roque</td></tr>
<tr><td>Lecturers</td><td colspan="5">- Teobaldo Roque
- Juan Corcuera</td></tr>
<tr><td>Language</td><td colspan="5">Spanish</td></tr>
<tr><td>Relation to curriculum</td><td colspan="5">Compulsory</td></tr>
<tr><td>Type of teaching, contact hours</td><td colspan="5">Contact hours and class size separately for each teaching method: lecture, lesson, practical, project, seminar, etc.
<table>
<tr><th>Nr</th><th>Courses ID</th><th>Contact hours per week</th><th>Teaching Method</th><th>Class Size</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">QQ3100</td><td>1.0</td><td>Lecture</td><td>40 students</td></tr>
<tr><td>2.0</td><td>Laboratory</td><td>20 students</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">QQ3030</td><td>4.0</td><td>Lecture</td><td>40 students</td></tr>
<tr><td>4.0</td><td>Practical</td><td>20 students</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">QQ4050</td><td>3.0</td><td>Lecture</td><td>40 students</td></tr>
<tr><td>4.0</td><td>Laboratory</td><td>20 students</td></tr>
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</td></tr>
<tr><td>Workload</td><td colspan="5">(Estimated) workload, divided into contact hours (lecture, exercise, laboratory session, etc.) and private study, including examination preparation, specified in hours.
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<tr><th>Nr</th><th>Courses</th><th>Contact Hours per week</th><th>Private Study per week</th><th>Total Workload</th><th>ECTS Credits</th></tr>
<tr><td>1</td><td>QQ3100</td><td>3.0</td><td>2.4</td><td>97</td><td>3</td></tr>
<tr><td>2</td><td>QQ3030</td><td>8.0</td><td>2.8</td><td>194</td><td>6</td></tr>
<tr><td>3</td><td>QQ4050</td><td>7.0</td><td>3.8</td><td>194</td><td>6</td></tr>
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<tr><td>Requirements according to the examination regulations</td><td colspan="5">In order to pass each course of the module, student must obtain a minimal final grade of 11 (eleven). To compute the final grade, the fraction 0.5 or more is considered as a unit in favor the student. (Exam. Reg. 2013 Art. 21)</td></tr>
<tr><td>Recommended prerequisites</td><td colspan="5">Formal: None
Content: Materials and Mathematics knowledge, and computing skill</td></tr>
<tr><td>Module objectives/intended learning outcomes</td><td colspan="5">After having finished the module, students are able to:
Knowledge:
- Interpret fundamentals for the development of processing operations used to concentrate minerals (comminution, grinding-listing, floating and solid liquid separation/distinction).
- Analyze and interpret the hydrometallurgical chemical process developed to extract metals contained in ores.
Skills:
- Calculate and design unit operations to concentrate a specific mineral type.
- Supervise the performance of hydrometallurgical and mineralogical processes of mineral treatment.
- Calculate and make the metallurgical balance in operations of mineral processing and hydrometallurgical processes.
Competences:
- Evaluate and optimize the performance of unit operations such as crushing, grinding, foam flotation and water removal in the process of mineral concentration.
- Carry out metallurgical tests on concentration and leaching of minerals at</td></tr>
</table>

	batch level and pilot plant level.
Content	***General Metallurgy:*** *Mineralogy. Common determinations in minerals. Ways of mining, transporting and handling minerals. Valuation of concentrated minerals. Metallurgical laboratory equipment. Minerallurgy. Inspection of a pilot plant of mineral concentration. Hydrometallurgical processes. Sampling of minerals. Pyrometallurgical processes. Electrical refining of metals. Granulometric analysis in coarse samples. Non-ferrous metals alloys. Granulometric analysis of samples ground. Ferrous metals alloys. Leaching of minerals. Metallurgy of transformation. New materials.* ***Mineral Processing I****: Metallurgical and mineralogy. Percentage of most common metal in minerals. Unit processes of ore preparation - Metallurgical Balances; Dry Comminution - crushing; Wet Comminution - Grinding – Classification. Gravimetric concentration. Minerals Flotation– Materials Balance in mineral flotation plant-separation solid-liquid – filtration. Environment and safety mining.* ***Mineral Processing II****: Hydrometallurgical Processes of metals - Leaching of minerals – Leaching Techniques. - Metallurgical Balances. Leaching of sulphureted copper ores. Hydrometallurgy of Zinc. Cyanidation of gold minerals - Project: Design of the stages of a gold ore treatment. Gold with activated carbon recovery - Recovery of gold by cementation; Pressure Leach. Electro-deposition of metals.*
Study and examination requirements and forms of examination	*Laboratory: preparations with review, functional projects, lab reports* *Lecture: partial written tests and final written exam*
Media employed	*Blackboard, slides, beamer presentations, demonstration of lab examples and experiments, lab development tools and equipment*
Reading list	- *Moore, John W. (1986) Metalurgia Química. Madrid/Alhambra S.A (669/M85).* - *Rivera Zeballos, Juan H. (2003) Compendio de conminución. Lima.: Concytec (669/R68)* - *Wills, B.A. (1994). Tecnología de procesamiento de minerales. Tratamiento de minas. México D.F.: Limusa (669/W58).* - *Habashi, Fathi (1980) Principles of Extractive Metallurgy. New York/Gordon and Breach (669/H11/v.1)* - *Allen, Dell (1981). Metallurgy Theory and Practice. Chicago/American Technical Pub.Inc. (669/A43).* - *Chia Aquije, J. (1985) Operaciones unitarias en procesamiento de minerales. Lima: UNI (660.284/CH548)* - *Manzaneda Cabala, José (2000). Procesamiento de mineral chancado, molienda, flotación, diseño experimental, microscopia. Lima: UNI (660.28422/M22)* - *Mc Innes, B. I., Mc Bride, J. S, Evans, N J, Lambert, D D, & Andrew, A S (Oct 15, 1999). Osmium Isotope Constraints on Ore Metal Recycling in Subduction Zones. Science, 286, 5439. p.512. Recuperado Dec 31,2009* - *Minerals processing comes of age. (May 1, 2009). PACE (Process & Control Engineering), 00, 00. p.0. Recuperado December 31, 2009, de Engineering Plus via Gale: http://find.galegroup.com/gps/start.do?prodId=IPS&userGroupName=tecsup* - *Mular, Andrew L. (2002) Mineral Processing plant design. Vol. 1 New York: American Institute of Minning (622.7/M93/v.1)* - *Mular, Andrew L. (2002) Mineral Processing plant design. Vol. 2 New York: American Institute of Minning (622.7/M93/v.2)* - *Rivera Zeballos, Juan H. (2003) Compendio de conminución. Lima.: Concytec (669/R68)* - *Wills, B.A. (1994). Tecnología de procesamiento de minerales. Tratamiento de minas. México D.F.: Limusa (669/W58)* - *Barratt, D, & McElroy, R (June 1990). Heap leaching for precious metals. E-MJ - Engineering & Mining Journal, 191, n6. p.40(7). Retrieved December 31,*

	2009, from Engineering Plus via Gale: http://find.galegroup.com/gtx/start.do?prodId=S - *CEPECT (1991) El oro. Lima: CEPECT. (669.22/CI)* - *Chia Aquije, J. (1985) Operaciones unitarias en procesamiento de minerales. Lima: UNI. (660.2844/CH548)* - *Clifford, D. (August 1996) Stacking systems in heap leaching. Mining Magazine, 175, n2. p.90(4). Retrieved December 31, 2009, from Engineering Plus via Gale: http://find.galegroup.com/gtx/start.do?prodId=SPJ.SP02&userGroupName=tecsup* - *Domic M., Esteban (2001) Hidrometalurgia. Fundamentos, procesos y aplicaciones. Santiago de Chile: s.n. (669/D88).* - *Solvent extraction solutions. Dec 2008 v209 i10 p48(4)E&MJ - Engineering & Mining Journal, 209, 10. p.48(4). Retrieved December 31, 2009, from Engineering Plus via Gale: http://find.galegroup.com/gtx/start.do?prodId=SPJ.SP02&userGroupName=tecsup*

Chemical Analysis Module

<table>
<tr><td>Degree Program</td><td colspan="5">Chemical and Metallurgical Processes</td></tr>
<tr><td>Module designation</td><td colspan="5">Analytic Chemistry</td></tr>
<tr><td>Module level, if applicable</td><td colspan="5"></td></tr>
<tr><td>Code, if applicable</td><td colspan="5">QM-04</td></tr>
<tr><td>Courses and Semester(s) in which the module is taught</td><td colspan="5">
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<tr><th>Courses</th><th>ID</th><th>Semester</th></tr>
<tr><td>- Analytical Chemistry I</td><td>QQ4010</td><td>4</td></tr>
<tr><td>- Analytical Chemistry II</td><td>QQ5010</td><td>5</td></tr>
<tr><td>- Environmental Analytical Chemistry</td><td>QQ6010</td><td>6</td></tr>
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<tr><td>Person responsible for the Module</td><td colspan="5">- Marixa Zegarra</td></tr>
<tr><td>Lecturers</td><td colspan="5">- Marixa Zegarra
- Hernán Zapata</td></tr>
<tr><td>Language</td><td colspan="5">Spanish</td></tr>
<tr><td>Relation to curriculum</td><td colspan="5">Compulsory</td></tr>
<tr><td>Type of teaching, contact hours</td><td colspan="5">Contact hours and class size separately for each teaching method: lecture, lesson, practical, project, seminar, etc.
<table>
<tr><th>Nr</th><th>Courses ID</th><th>Contact hours per week</th><th>Teaching Method</th><th>Class Size</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">QQ4010</td><td>3.0</td><td>Lecture</td><td>40 students</td></tr>
<tr><td>4.0</td><td>Laboratory</td><td>20 students</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">QQ5010</td><td>2.0</td><td>Lecture</td><td>40 students</td></tr>
<tr><td>2.5</td><td>Practical</td><td>20 students</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">QQ6010</td><td>2.0</td><td>Lecture</td><td>40 students</td></tr>
<tr><td>1.5</td><td>Laboratory</td><td>20 students</td></tr>
</table>
</td></tr>
<tr><td>Workload</td><td colspan="5">(Estimated) workload, divided into contact hours (lecture, exercise, laboratory session, etc.) and private study, including examination preparation, specified in hours.
<table>
<tr><th>Nr</th><th>Courses</th><th>Contact Hours per week</th><th>Private Study per week</th><th>Total Workload</th><th>ECTS Credits</th></tr>
<tr><td>1</td><td>QQ4010</td><td>7.0</td><td>3.8</td><td>194</td><td>6</td></tr>
<tr><td>2</td><td>QQ5010</td><td>4.5</td><td>3.4</td><td>142</td><td>5</td></tr>
<tr><td>3</td><td>QQ6010</td><td>3.5</td><td>3.1</td><td>119</td><td>4</td></tr>
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</td></tr>
<tr><td>Requirements according to the examination regulations</td><td colspan="5">In order to pass each course of the module, student must obtain a minimal final grade of 11 (eleven). To compute the final grade, the fraction 0.5 or more is considered as a unit in favor the student. (Exam. Reg. 2013 Art. 21)</td></tr>
<tr><td>Recommended prerequisites</td><td colspan="5">Formal: None
Content: General Chemistry and Mathematics knowledge, and computing skill</td></tr>
<tr><td>Module objectives/intended learning outcomes</td><td colspan="5">After having finished the module, students are able to:
Knowledge:
- Interpret the fundamental principles of the chemical balance applied to gravimetric and volumetric determinations of acid neutralization, precipitation, and oxide reduction.
- Describe and interpret the basis of instrumental chemical analysis in spectroscopy, chromatography.
- Analyze and interpret the various methodologies and analytical Instrumentation of wider applicability in the study and control of the quality of the environment.
Skills:
- Perform the appropriate calculations of gravimetric and volumetric analysis and interpret analytical results.
- Evaluate and apply methodologies of chemical analysis, by molecular, atomic spectroscopy and chromatographic techniques of analysis.
- Apply normal procedures for sampling and analysis of air, water and soil.
Competences:
- Sort, calibrate and check out the operation of glass materials and</td></tr>
</table>

	instrumental equipment form the analytical chemical laboratory. - *Develop tests for required chemical analysis to determine the composition of, liquid, solid and gas substances.* - *Evaluate and define the quality of effluents and other emissions that are generated in the production industry.*
Content	***Analytical Chemistry I:*** *Introduction to chemical analysis. Gravimetric analysis I Volumetric analysis. Acid-base volumetry. Volumetry of precipitation. Volumetry of complex formation. Redox tiration.* ***Analytical Chemistry II****: Fundamentals of Instrumental chemical analysis - classification of instrumental techniques - components of an instrument; Introduction to spectroscopic analysis methods; Molecular absorption spectrophotometry - instrumentation for molecular absorption - application of the* ***Chromophores*** *theory to the Molecular absorption; Fundamentals of atomic absorption spectroscopy – Instrumentation in EAA - Interference in EAA; Chromatography - chromatography instrumentation – qualitative and quantitative analysis in gas chromatography.* ***Environmental Analytical Chemistry****. Analysis of air – Design of air quality equipment - permissible limits of air quality; Analysis of water - Environmental monitoring of surface and ground waters - physical analysis of water - application of volumetric water analysis - analysis of sulphates, sodium and potassium, organic matter, oxygen dissolved; Analysis of soil - sampling - chemical analysis; Exhibition of projects - chemical analysis of industrial waste water.*
Study and examination requirements and forms of examination	*Laboratory: preparations with review, functional projects, lab reports* *Lecture: partial written tests and final written exam*
Media employed	*Blackboard, slides, beamer presentations, demonstration of lab examples and experiments, lab development tools and equipment*
Reading list	- *Ayres, Gilbert (1970) Análisis químico cuantitativo. México D.F.: Harla S.A. (543/A94).* - *Fritz, James (1989) Química analítica cuantitativa. México D.F.: Limusa (543/F84).* - *Hamilton, Leicester (1981) Cálculos de química analítica. México D.F.: Mc Graw-Hill. (543/H19)* - *Skoog, Douglas (1986) Análisis instrumental. México D.F.: Interamericana. (543/S47).* - *Vogel, Arthur (1960) Química analítica cuantitativa. Buenos Aires: Kapelusz. (543/V82).* - *Willard, Hobart (1965) Instrumental methodsofanalysis. New Jersey: Van Nostrand. (621.381ME/W56).* - *American Public Health Association (1996) Métodos normalizados para el análisis de aguas potables y residuales. Madrid: Díaz de Santos. (628.1/A).*

Industrial Technology Processes Module

<table>
<tr><td>Degree Program</td><td colspan="5">Chemical and Metallurgical Processes</td></tr>
<tr><td>Module designation</td><td colspan="5">Industrial Technology Processes</td></tr>
<tr><td>Module level, if applicable</td><td colspan="5"></td></tr>
<tr><td>Code, if applicable</td><td colspan="5">QM-05</td></tr>
<tr><td rowspan="3">Courses and Semester(s) in which the module is taught</td><td colspan="3">Courses</td><td>ID</td><td>Semester</td></tr>
<tr><td colspan="3">- Industrial Chemistry I</td><td>QQ5050</td><td>5</td></tr>
<tr><td colspan="3">- Industrial Chemistry II</td><td>QQ6050</td><td>6</td></tr>
<tr><td>Person responsible for the Module</td><td colspan="5">- Alfredo Ugarte</td></tr>
<tr><td>Lecturer</td><td colspan="5">- Alfredo Ugarte</td></tr>
<tr><td>Language</td><td colspan="5">Spanish</td></tr>
<tr><td>Relation to curriculum</td><td colspan="5">Compulsory</td></tr>
<tr><td>Type of teaching, contact hours</td><td colspan="5">Contact hours and class size separately for each teaching method: lecture, lesson, practical, project, seminar, etc.
<table>
<tr><th>Nr</th><th>Courses ID</th><th>Contact hours per week</th><th>Teaching Method</th><th>Class Size</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">QQ5050</td><td>2.0</td><td>Lecture</td><td>40 students</td></tr>
<tr><td>1.5</td><td>Laboratory</td><td>20 students</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">QQ6050</td><td>2.0</td><td>Lecture</td><td>40 students</td></tr>
<tr><td>2.5</td><td>Laboratory</td><td>20 students</td></tr>
</table></td></tr>
<tr><td>Workload</td><td colspan="5">(Estimated) workload, divided into contact hours (lecture, exercise, laboratory session, etc.) and private study, including examination preparation, specified in hours.
<table>
<tr><th>Nr</th><th>Courses</th><th>Contact Hours per week</th><th>Private Study per week</th><th>Total Workload</th><th>ECTS Credits</th></tr>
<tr><td>1</td><td>QQ5050</td><td>3.5</td><td>3.0</td><td>117</td><td>4</td></tr>
<tr><td>2</td><td>QQ6050</td><td>4.5</td><td>2.9</td><td>133</td><td>4</td></tr>
</table></td></tr>
<tr><td>Requirements according to the examination regulations</td><td colspan="5">In order to pass each course of the module, student must obtain a minimal final grade of 11 (eleven). To compute the final grade, the fraction 0.5 or more is considered as a unit in favor the student. (Exam. Reg. 2013 Art. 21)</td></tr>
<tr><td>Recommended prerequisites</td><td colspan="5">Formal: None
Content: Chemical and Mathematics knowledge, and computing skill</td></tr>
<tr><td>Module objectives/intended learning outcomes</td><td colspan="5">After having finished the module, students are able to:
Knowledge:
- .
- Interpret the fundamentals and chemistry knowledge to be applied to processes that involve chemical reactions.
- Analyze and explain the influence of the main variables from chemical processes of refining and production of carbohydrate.
Skills:
- The procedures for obtaining industrial chemicals are evaluated in order to determine their efficiency and productivity.
- Supervises the performance of industrial chemical processes from manufacture of substances required by society.
Competences:
- Evaluate and optimize the performance of the chemical processes used in the industrial production of organic and inorganic substances.
- Evaluate and select the industrial processing technologies available for organic and inorganic substances.</td></tr>
<tr><td>Content</td><td colspan="5">Industrial Chemistry I: The Industrial plant and services plant - flow diagrams - Project: Design of reverse osmosis water treatment systems; Process of manufacture and use of industrial gases; Distribution of water in the Industrial plant - methods of water treatment for Industrial use - Softening - Reverse Osmosis; Thermodynamic Properties of steam Water - Steam distribution systems in the plant - steam boilers; Study of the corrosion phenomenon - types and external factors affecting it; Industrial air conditioning systems - Applications.</td></tr>
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	***Industrial Chemistry II**: Techniques for refining oil and natural gas. The thermal cracking. Catalytic cracking; Techniques for gasoline improvement - Reformed. Alkylation, isomerization; Technical aspects of polymerization - Ethylene polymers - Industrial plastics products; Industrial catalysis; Technology of fats and oils - saponification process - Production of alcohol and biodiesel; The industry of tenseactives agents; The importance of the sugar industry; Industry of dyes and pigments; Industrial paints.*
Study and examination requirements and forms of examination	*Laboratory: preparations with review, lab reports* *Lecture: partial written tests and final written exam*
Media employed	*Blackboard, slides, beamer presentations, demonstration of lab examples and experiments, lab development tools and equipment*
Reading list	- *Austin, George (1990) Manual de procesos químicos en la industria. México D.F.: Mc Graw-Hill. (661/A88/t.1), (661/A88/t.2), (661/A88/t.3)* - *Baumeister,Theodore (1986) Marks manual del ingeniero mecánico. Vol. 1, 2 y 3 México D.F.: Mc Graw - Hill. (620.1/B28/v.1, v.2 y v.3).* - *Fogler, Scott (2001) Elementos de ingeniería de las reacciones químicas. México D.F.: Pearson Educación. (660/F71).* - *Kent, James (1984) Manual de Riegel de química industrial. México D.F.: Continental. (660/K41).* - *Otero Huerta, Enrique (2001) Corrosión y degradación de materiales. Madrid: s.n. (620.11223/O86).* - *Perry, John (1974) Manual de ingeniero químico. Tomo 1 y 2. México D.F.: Unión Tipográfica. (660/P43/t.1 y t.2).* - *Riegel, Emil Raymond (1942) Industrial chemistry. New York: H. Holt and Co. (661/R56).*

Applied Technology Module

<table>
<tr><td>Degree Program</td><td colspan="5">Chemical and Metallurgical Processes</td></tr>
<tr><td>Module designation</td><td colspan="5">Applied Technology</td></tr>
<tr><td>Module level, if applicable</td><td colspan="5"></td></tr>
<tr><td>Code, if applicable</td><td colspan="5">QM-06</td></tr>
<tr><td rowspan="3">Courses and Semester(s) in which the module is taught</td><td colspan="3">Courses</td><td>ID</td><td>Semester</td></tr>
<tr><td colspan="3">- Environmental Engineering</td><td>QQ6090</td><td>6</td></tr>
<tr><td colspan="3">- Industrial Control and Automation</td><td>AQ5010</td><td>5</td></tr>
<tr><td>Person responsible for the Module</td><td colspan="5">- Hernán Zapata</td></tr>
<tr><td>Lecturers</td><td colspan="5">- Hernán Zapata
- Armando Sarco</td></tr>
<tr><td>Language</td><td colspan="5">Spanish</td></tr>
<tr><td>Relation to curriculum</td><td colspan="5">Compulsory</td></tr>
<tr><td>Type of teaching, contact hours</td><td colspan="5">Contact hours and class size separately for each teaching method: lecture, lesson, practical, project, seminar, etc.
<table>
<tr><th>Nr</th><th>Courses ID</th><th>Contact hours per week</th><th>Teaching Method</th><th>Class Size</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">QQ6090</td><td>2.0</td><td>Lecture</td><td>40 students</td></tr>
<tr><td>2.0</td><td>Laboratory</td><td>20 students</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">AQ5010</td><td>2.0</td><td>Lecture</td><td>40 students</td></tr>
<tr><td>1.0</td><td>Laboratory</td><td>20 students</td></tr>
</table></td></tr>
<tr><td>Workload</td><td colspan="5">(Estimated) workload, divided into contact hours (lecture, exercise, laboratory session, etc.) and private study, including examination preparation, specified in hours.
<table>
<tr><th>Nr</th><th>Courses</th><th>Contact Hours per week</th><th>Private Study per week</th><th>Total Workload</th><th>ECTS Credits</th></tr>
<tr><td>1</td><td>QQ6090</td><td>4.0</td><td>3.8</td><td>140</td><td>5</td></tr>
<tr><td>2</td><td>AQ5010</td><td>3.0</td><td>2.0</td><td>90</td><td>3</td></tr>
</table></td></tr>
<tr><td>Requirements according to the examination regulations</td><td colspan="5">In order to pass each course of the module, student must obtain a minimal final grade of 11 (eleven). To compute the final grade, the fraction 0.5 or more is considered as a unit in favor the student. (Exam. Reg. 2013 Art. 21)</td></tr>
<tr><td>Recommended prerequisites</td><td colspan="5">Formal: None
Content: Chemical and Mathematics knowledge, and computing skill</td></tr>
<tr><td>Module objectives/intended learning outcomes</td><td colspan="5">After having finished the module, students are able to:
Knowledge:
- Interpret the fundamentals and chemistry knowledge to be applied to processes that involve chemical reactions.
- Analyze and explain the influence of the main variables of the refining chemical processes and production of carbohydrate.
Skills:
- Evaluate the procedures for obtaining industrial chemicals in order to determine their efficiency and productivity.
- Supervise the performance of industrial chemical processes of manufacture of substances required by the society.
Competences:
- Evaluate and optimize the performance of the chemical processes used in the industrial production of organic and inorganic substances.
- Evaluate and select the available industrial processing technologies available for organic and inorganic substances.</td></tr>
<tr><td>Content</td><td colspan="5">Environmental Engineering: Fundamentals of environmental toxicology. Disposal of inorganic pollutants in water. Coagulation and flocculation techniques. Air pollution. Water pollution. Treatment of cyanided waste water. Treatment of activated sludge. Soil pollution.

Industrial Control and Automation: Instrumentation and control. Pressure measurement. Temperature measurement. Measurement of miscellaneous variables. Level and flow measurement. Characteristics of the processes.</td></tr>
</table>

	Fundamentals of control. Controllers tuning. Instrumentation and control symbols Digital instruments and systems. Interpreting control plans and P&ID in a plant
Study and examination requirements and forms of examination	*Laboratory: preparations with review, lab reports* *Lecture: partial written tests and final written exam*
Media employed	*Blackboard, slides, beamer presentations, demonstration of lab examples and experiments, lab development tools and equipment*
Reading list	- *Armas Ramirez, Carlos (2001) Tecnología ambiental. En nuestro hogar la nave sideral tierra. Lima: Concytec. (574.5/A74).* - *Henry, Glynn (1999) Ingeniería ambiental. México D.F.: Prentice. Hall (574.5/H39).* - *Creus Sole, Antonio (2006) Instrumentación industrial. México D.F.: Alfaomega (621.381I/C85/2006).* - *Solar, Ivan (1998) Control automático de procesos químicos. Santiago de Chile: Universidad Católica de Chile (660/S66).* - *Szklanny, Sergio (1995) Sistemas digitales de control de procesos. Buenos Aires: s.n. (621.381I/S99).*

Industrial Operations Module

<table>
<tr><td>Degree Program</td><td colspan="5">Chemical and Metallurgical Processes</td></tr>
<tr><td>Module designation</td><td colspan="5">Industrial Operations</td></tr>
<tr><td>Module level, if applicable</td><td colspan="5"></td></tr>
<tr><td>Code, if applicable</td><td colspan="5">QM-07</td></tr>
<tr><td rowspan="3">Courses and Semester(s) in which the module is taught</td><td colspan="3">Courses</td><td>ID</td><td>Semester</td></tr>
<tr><td colspan="3">- Industrial Operations I</td><td>QQ5030</td><td>5</td></tr>
<tr><td colspan="3">- Industrial Operations II</td><td>QQ6030</td><td>6</td></tr>
<tr><td>Person responsible for the Module</td><td colspan="5">- Gerard Franklin</td></tr>
<tr><td>Lecturer</td><td colspan="5">- Gerard Franklin</td></tr>
<tr><td>Language</td><td colspan="5">Spanish</td></tr>
<tr><td>Relation to curriculum</td><td colspan="5">Compulsory</td></tr>
<tr><td>Type of teaching, contact hours</td><td colspan="5">Contact hours and class size separately for each teaching method: lecture, lesson, practical, project, seminar, etc.
<table>
<tr><th>Nr</th><th>Courses ID</th><th>Contact hours per week</th><th>Teaching Method</th><th>Class Size</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">QQ5030</td><td>2.0</td><td>Lecture</td><td>40 students</td></tr>
<tr><td>3.0</td><td>Laboratory</td><td>20 students</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">QQ6030</td><td>2.0</td><td>Lecture</td><td>40 students</td></tr>
<tr><td>3.0</td><td>Laboratory</td><td>20 students</td></tr>
</table></td></tr>
<tr><td>Workload</td><td colspan="5">(Estimated) workload, divided into contact hours (lecture, exercise, laboratory session, etc.) and private study, including examination preparation, specified in hours.
<table>
<tr><th>Nr</th><th>Courses</th><th>Contact Hours per week</th><th>Private Study per week</th><th>Total Workload</th><th>ECTS Credits</th></tr>
<tr><td>1</td><td>QQ5030</td><td>5.0</td><td>2.4</td><td>133</td><td>4</td></tr>
<tr><td>2</td><td>QQ6030</td><td>5.0</td><td>2.4</td><td>133</td><td>4</td></tr>
</table></td></tr>
<tr><td>Requirements according to the examination regulations</td><td colspan="5">In order to pass each course of the module, student must obtain a minimal final grade of 11 (eleven). To compute the final grade, the fraction 0.5 or more is considered as a unit in favor the student. (Exam. Reg. 2013 Art. 21)</td></tr>
<tr><td>Recommended prerequisites</td><td colspan="5">Formal: None
Content: Chemical and Mathematics knowledge, and computing skill.</td></tr>
<tr><td>Module objectives/intended learning outcomes</td><td colspan="5">After having finished the module, students are able to:
Knowledge:
- Identify equipment and machines of unit operations.
- Recognize the operation of machines of unit operations.
Skills:
- Operate and monitor the equipment and machines in unit operations.
- Apply control of safety and environmental protection in the unit operations.
Competences:
- Design equipment for the unit operations applying safety conditions and environmental protection.
- Control and optimize industrial processes into unit operations.</td></tr>
<tr><td>Content</td><td colspan="5">Industrial Operations I: Introduction to unit operations – identification of pump and heat exchanger. Fluid tanks, pipes and fittings - Bernoulli's Theoreme; Identification and evaluation of fluid flow problems; Selection of industrial pumps - centrifugal pumps operating problems; Operation of compressors; Heat transfer processes; Transport of solids; Agitation of liquid solutions.

Industrial Operations II : Industrial evaporation - classification of evaporators; Physical principles in the operation of distillation - distillation Batch - Continuous distillation - Balance of matter and energy of a rectifier - Evaluate problems of distillation; Theory of drying; Separation of solids and liquids; Crystallization in the industry. Industrial refrigeration systems; Operation of filtration; Principles of drying.</td></tr>
<tr><td>Study and examination requirements and forms of</td><td colspan="5">Laboratory: preparations with review, lab reports
Lecture: partial quizzes and final written examination</td></tr>
</table>

examination	
Media employed	*Blackboard, slides, beamer presentations, demonstration of lab examples and experiments, lab development tools and equipment*
Reading list	- *Ocón García, Joaquín (1986) Problemas de ingeniería química. Madrid: Aguilar S.A. (660.01/O29/t.1), (660.01/O29/t.2).* - *Perry John (1974) Manual del ingeniero químico. Tomo 1 México D.F.: Unión Tipográfica. (660/P43/t.1 y t.2)).* - *Badger, Walter (1936) Elements of chemical engineering. New York: Mc Graw-Hill (B660/B14)*

Chemical Processes Module

<table>
<tr><td>Degree Program</td><td colspan="5">Chemical and Metallurgical Processes</td></tr>
<tr><td>Module designation</td><td colspan="5">Chemical Processes</td></tr>
<tr><td>Module level, if applicable</td><td colspan="5"></td></tr>
<tr><td>Code, if applicable</td><td colspan="5">QM-08</td></tr>
<tr><td rowspan="3">Courses and Semester(s) in which the module is taught</td><td colspan="3">Courses</td><td>ID</td><td>Semester</td></tr>
<tr><td colspan="3">- Chemical Processes</td><td>QQ4030</td><td>4</td></tr>
<tr><td colspan="3">- Food Industries</td><td>QQ4080</td><td>4</td></tr>
<tr><td>Person responsible for the Module</td><td colspan="5">- Enrique Ames</td></tr>
<tr><td>Lecturers</td><td colspan="5">- Enrique Ames
- Gerard Franklin</td></tr>
<tr><td>Language</td><td colspan="5">Spanish</td></tr>
<tr><td>Relation to curriculum</td><td colspan="5">Compulsory</td></tr>
<tr><td>Type of teaching, contact hours</td><td colspan="5">Contact hours and class size separately for each teaching method: lecture, lesson, practical, project, seminar, etc.
<table>
<tr><th>Nr</th><th>Courses ID</th><th>Contact hours per week</th><th>Teaching Method</th><th>Class Size</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">QQ4030</td><td>3.0</td><td>Lecture</td><td>40 students</td></tr>
<tr><td>2.0</td><td>Laboratory</td><td>20 students</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">QQ4080</td><td>1.0</td><td>Lecture</td><td>40 students</td></tr>
<tr><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Workload</td><td colspan="5">(Estimated) workload, divided into contact hours (lecture, exercise, laboratory session, etc.) and private study, including examination preparation, specified in hours.
<table>
<tr><th>Nr</th><th>Courses</th><th>Contact Hours per week</th><th>Private Study per week</th><th>Total Workload</th><th>ECTS Credits</th></tr>
<tr><td>1</td><td>QQ4030</td><td>5.0</td><td>3.6</td><td>155</td><td>5</td></tr>
<tr><td>2</td><td>QQ4080</td><td>1.0</td><td>2.5</td><td>63</td><td>2</td></tr>
</table></td></tr>
<tr><td>Requirements according to the examination regulations</td><td colspan="5">In order to pass each course of the module, student must obtain a minimal final grade of 11 (eleven). To compute the final grade, the fraction 0.5 or more is considered as a unit in favor the student. (Exam. Reg. 2013 Art. 21)</td></tr>
<tr><td>Recommended prerequisites</td><td colspan="5">Formal: None
Content: Chemical and Mathematics knowledge, and computing skill</td></tr>
<tr><td>Module objectives/intended learning outcomes</td><td colspan="5">After having finished the module, students are able to:
Knowledge:
- Interpret the fundamentals and chemistry knowledge to be applied to processes that involve chemical reactions
- Analyze and explain the influence of the main variables of chemical processes of refining and production of carbohydrate.
Skills:
- Evaluate the procedures for obtaining industrial chemicals in order to determine their efficiency and productivity.
- Supervise the performance of industrial chemical processes of manufacture of substances required by society.
Competences:
- Evaluate and optimize the performance of chemical processes used in the industrial production of organic and inorganic substances.
- Evaluate and select the available industrial processing technologies for organic and inorganic substances.</td></tr>
<tr><td>Content</td><td colspan="5">Chemical Processes: Balance of mass and energy in industrial processes - Fermentation process; Production of essential oils; Industrial chemical reactors and complementary operations in chemical processes; Preparation of ammonium sulphate; Inorganic and organic chemical industry - Preparation of metallic soaps - a sodium SOAP preparation - Preparation of normal lead stearate; Oil and natural gas.</td></tr>
</table>

	***Food industries**: Biochemical basis of fermentation - The Biotechnology – Enzymes. Foods derived from fermentation – Alcoholic Fermentation - Monosodium glutamate – Wine production. Dairy food industry - cheese, cream, butter. Evaporated milk and concentrated milk. Condensed milk and milk powder. Preparation of yogurt. Manufacturing processes – Sugar, starch and by-products.; Natural carbohydrate food products. Operations and processes in the meat industry.*
Study and examination requirements and forms of examination	*Laboratory: preparations with review, lab reports* *Lecture: partial written tests and final written exam*
Media employed	*Blackboard, slides, beamer presentations, demonstration of lab examples and experiments, lab development tools and equipment*
Reading list	- *Austin, George (1990) Manual de procesos químicos en la industria. México D.F.: Mc Graw-Hill. (661/A88/t.1), (661/A88/t.2), (661/A88/t.3)* - *Felder, Richard (2008) Principios elementales de los procesos químicos. México D.F.: Limusa Wiley. (660/F36)* - *Fogler, Scott (2001) Elementos de ingeniería de las reacciones químicas. México D.F.: Pearson Educación. (660/F71).* - *Himmelblau, David (1986) Principios y cálculos básicos de la ingeniería química. México D.F.: Continental. (660.01/H55)).* - *Kent, James (1984) Manual de Riegel. Química industrial. México D.F.: Continental. (660/K41)..* - *Riegel, Emil (1974) Riegel´s handbook of industrial chemistry. New York: Van Nostrand Reinhold. (B660/R54)*

Metallurgical Processes Module

<table>
<tr><td>Degree Program</td><td colspan="5">Chemical and Metallurgical Processes</td></tr>
<tr><td>Module designation</td><td colspan="5">Metallurgical Processes</td></tr>
<tr><td>Module level, if applicable</td><td colspan="5"></td></tr>
<tr><td>Code, if applicable</td><td colspan="5">QM-09</td></tr>
<tr><td rowspan="3">Courses and Semester(s) in which the module is taught</td><td colspan="3">Courses</td><td>ID</td><td>Semester</td></tr>
<tr><td colspan="3">- Metallurgical Processes I</td><td>QQ5070</td><td>5</td></tr>
<tr><td colspan="3">- Metallurgical Processes II</td><td>QQ6070</td><td>6</td></tr>
<tr><td>Person responsible for the Module</td><td colspan="5">- Enrique Cáceres</td></tr>
<tr><td>Lecturers</td><td colspan="5">- Enrique Cáceres
- Juan Corcuera</td></tr>
<tr><td>Language</td><td colspan="5">Spanish</td></tr>
<tr><td>Relation to curriculum</td><td colspan="5">Compulsory</td></tr>
<tr><td>Type of teaching, contact hours</td><td colspan="5">Contact hours and class size separately for each teaching method: lecture, lesson, practical, project, seminar, etc.
<table>
<tr><th>Nr</th><th>Courses ID</th><th>Contact hours per week</th><th>Teaching Method</th><th>Class Size</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">QQ5070</td><td>2.0</td><td>Lecture</td><td>40 students</td></tr>
<tr><td>1.5</td><td>Laboratory</td><td>20 students</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">QQ6070</td><td>2.0</td><td>Lecture</td><td>40 students</td></tr>
<tr><td>2.5</td><td>Laboratory</td><td>20 students</td></tr>
</table></td></tr>
<tr><td>Workload</td><td colspan="5">(Estimated) workload, divided into contact hours (lecture, exercise, laboratory session, etc.) and private study, including examination preparation, specified in hours.
<table>
<tr><th>Nr</th><th>Courses</th><th>Contact Hours per week</th><th>Private Study per week</th><th>Total Workload</th><th>ECTS Credits</th></tr>
<tr><td>1</td><td>QQ5070</td><td>3.5</td><td>2.9</td><td>115</td><td>4</td></tr>
<tr><td>2</td><td>QQ6070</td><td>4.5</td><td>2.1</td><td>119</td><td>4</td></tr>
</table></td></tr>
<tr><td>Requirements according to the examination regulations</td><td colspan="5">In order to pass each course of the module, student must obtain a minimal final grade of 11 (eleven). To compute the final grade, the fraction 0.5 or more is considered as a unit in favor the student. (Exam. Reg. 2013 Art. 21)</td></tr>
<tr><td>Recommended prerequisites</td><td colspan="5">Formal: None
Content: Chemical, Metallurgy and Mathematics knowledge, and computing skill</td></tr>
<tr><td>Module objectives/intended learning outcomes</td><td colspan="5">After having finished the module, students are able to:
Knowledge:
- Interpret the fundamentals and metallurgical chemistry expertise to be applied to chemical processes of extraction of metals.
- Evaluate and distinguish the phases that compose the Fe-C for the formation of steels.
Skills:
- Apply the mass and energy balance in a pyro metallurgical process. It is estimated the amount of industrial production taking into account the performance of the processes.
- Interpret and distinguish the physical characteristics both of ferrous alloys (steels) and non-ferrous alloys.
Competences:
- Evaluate and optimize the performance of the processes pyro metallurgical used in the industrial production of metals.
- Design of a ferrous alloy composition and predict its characteristics and behaviour.</td></tr>
<tr><td>Content</td><td colspan="5">Metallurgical Processes I: Extractive metallurgy – Metals extraction. Pyrometallurgic - Drying, calcining and toasting. Melting. Reduction of metallic oxides. Thermodynamic principles - Matte conversion., fire refining and distillation. Electrometallurgy. Industrial application; Metallurgy of Copper; Metallurgy of Lead, Metallurgy of Tin; Metallurgy of Zinc; Metallurgy of iron, Steel production; Metallurgy of Gold, Metallurgy of Silver; Pyro metallurgical processes effluent treatment; Metal smelting: Gold metallurgy. Secondary</td></tr>
</table>

	production of metals - recycling of junk. ***Metallurgical Processes II**: Structure of metals. Metallography - physical properties and mechanics of metals; Diagram of iron – Manufacturing of steel; Heat treatments - Thermochemical and Thermo Mechanical Treatment of Steel; Non-ferrous Alloys; Plastic deformation of metals; Metallurgy of welding; Refractory. Pulvimetallurgy.*
Study and examination requirements and forms of examination	*Laboratory: preparations with review, lab reports* *Lecture: partial written tests and final written exam*
Media employed	*Blackboard, slides, beamer presentations, demonstration of lab examples and experiments, lab development tools and equipment*
Reading list	- *Ballester, Antonio (2003) Metalurgia extractiva. Tomo 1. Madrid: s.n. (669/B18/t.1 y t.2* - *Biswas, Asit (1993) El cobre, metalurgia extractiva. México D.F.: Limusa (669/B56).* - *Bray, John (1968) Metalurgia extractiva de los materiales no ferreos. Madrid: OSCA. (669/B81).* - *Burroughs Gill, Charles (1989) Metalurgia extractiva no ferrosa. México D.F.: Limusa. (669/B77)* - *Rosenqvist, Terkel (1987) Fundamentos de metalurgia extractiva. México D.F.: Limusa (669/R84).* - *Appold, Hans (1984) Tecnología de los metales. Barcelona: Reverté. (669.9/A64).).* - *Lasheras y Esteban, José María (1985) Tecnología del acero. Barcelona: EMEGE. (669.142/L27).* - *William D. Callister (2009) Introducción a la Ciencia e Ingeniería de los Materiales. Barcelona: Reverté. (620.112/C23)*

Applied Mathematics Module

<table>
<tr><td>Degree Program</td><td colspan="5">Chemical and Metallurgical Processes</td></tr>
<tr><td>Module designation</td><td colspan="5">Applied Mathematics</td></tr>
<tr><td>Module level, if applicable</td><td colspan="5"></td></tr>
<tr><td>Code, if applicable</td><td colspan="5">QM-10</td></tr>
<tr><td rowspan="3">Courses and Semester(s) in which the module is taught</td><td colspan="3">Courses</td><td>ID</td><td>Semester</td></tr>
<tr><td colspan="3">- Applied Mathematics</td><td>QQ3080</td><td>3</td></tr>
<tr><td colspan="3">- Statistics Applied to Laboratories</td><td>QQ4070</td><td>4</td></tr>
<tr><td>Person responsible for the Module</td><td colspan="5">- Ernesto Zeña</td></tr>
<tr><td>Lecturer</td><td colspan="5">- Ernesto Zeña</td></tr>
<tr><td>Language</td><td colspan="5">Spanish</td></tr>
<tr><td>Relation to curriculum</td><td colspan="5">Compulsory</td></tr>
<tr><td>Type of teaching, contact hours</td><td colspan="5">Contact hours and class size separately for each teaching method: lecture, lesson, practical, project, seminar, etc.
<table>
<tr><th>Nr</th><th>Courses ID</th><th>Contact hours per week</th><th>Teaching Method</th><th>Class Size</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">QQ3080</td><td>2.0</td><td>Lecture</td><td>40 students</td></tr>
<tr><td>3.0</td><td>Laboratory</td><td>20 students</td></tr>
<tr><td>2</td><td>QQ4070</td><td>3.0</td><td>Laboratory</td><td>20 students</td></tr>
</table></td></tr>
<tr><td>Workload</td><td colspan="5">(Estimated) workload, divided into contact hours (lecture, exercise, laboratory session, etc.) and private study, including examination preparation, specified in hours.
<table>
<tr><th>Nr</th><th>Courses</th><th>Contact Hours per week</th><th>Private Study per week</th><th>Total Workload</th><th>ECTS Credits</th></tr>
<tr><td>1</td><td>QQ3080</td><td>5.0</td><td>3.3</td><td>149</td><td>5</td></tr>
<tr><td>2</td><td>QQ4070</td><td>3.0</td><td>4.4</td><td>133</td><td>4</td></tr>
</table></td></tr>
<tr><td>Requirements according to the examination regulations</td><td colspan="5">In order to pass each course of the module, student must obtain a minimal final grade of 11 (eleven). To compute the final grade, the fraction 0.5 or more is considered as a unit in favor the student. (Exam. Reg. 2013 Art. 21)</td></tr>
<tr><td>Recommended prerequisites</td><td colspan="5">Formal: None
Content: Chemical and Mathematics knowledge, and computing skill</td></tr>
<tr><td>Module objectives/intended learning outcomes</td><td colspan="5">After having finished the module, students are able to:
Knowledge:
- Analyze and interpret the methodology, techniques and probabilistic methods and statistical analysis to apply theoretical models and methods of analysis.
- Interpret the knowledge of mathematics related to linear algebra, differential calculus, integral calculus, differential equations.
Skills:
- Apply the derivative of a function, and the integral defined in chemical and metallurgical processes applications.
- Analyze and interpret data from laboratory chemical tests.
Competences:
- Design or describe mathematical models, so that can give response to scientific or technological issues, or social environment.
- Apply the Minitab 14 software and Excel (statistical tools), interpreting and evaluating the data generated in laboratories.</td></tr>
<tr><td>Content</td><td colspan="5">Applied Mathematics: Linear regression - Use of computer tools; Matrixes and determinants; Interpolation and extrapolation of data; Functions of distribution and heat transfer; Differential calculus; Integral Calculus; Differential equations; Kinetics of chemical processes - Application of differential equations in chemical kinetics processes; Kinetics of metallurgical processes.

Statistics Applied to Laboratories: Introduction of the Minitab and excel as a statistical tool - statistic repeated measures; Graphic of a variable and bivariate - accuracy, bias and accuracy. Types of errors; Statistical sampling; Point estimation and confidence limits for the mean and the variance - for the average and variance for hypothesis testing; Hypothesis testing for the media, for the variance and</td></tr>
</table>

	hypothesis for the mean difference; Analysis and design of experiments; Complete Blocks designs randomized and Latin squares; Simple linear regression, exponential regression, logarithmic regression, power regression. Multiple regression; Introduction to the factorial designs; Hex experimental design.
Study and examination requirements and forms of examination	*Laboratory: preparations with review, lab reports* *Lecture: partial written tests and final written exam*
Media employed	*Blackboard, slides, beamer presentations, demonstration of lab examples and experiments, lab development tools and equipment*
Reading list	- *Himmelblau, David M. (1986) Principios y cálculos básicos de la ingeniería química. México D.F.: Continental (660.01/H55))* - *McCabe, Warren L. (1981) Operaciones básicas de ingeniería química. Barcelona.: Reverté (540/M30).* - *Thompson, Edward V. (1979) Introducción a la ingeniería química. Bogotá: Mc Graw Hill. (660/T48).* - *Devore, Jay L. (2012) Probabilidad y estadística para ingeniería y ciencias. México, D. F. CENGAGE Learning. (519.5).* - *Montgomery, Douglas C. (2007) Diseño y análisis de experimentos. México D.F.: Limusa (001.434/M84/2008).*

Fundamental Technology Module

<table>
<tr><td>Degree Program</td><td colspan="5">Chemical and Metallurgical Processes</td></tr>
<tr><td>Module designation</td><td colspan="5">Fundamental Technology</td></tr>
<tr><td>Module level, if applicable</td><td colspan="5"></td></tr>
<tr><td>Code, if applicable</td><td colspan="5">QM-11</td></tr>
<tr><td rowspan="3">Courses and Semester(s) in which the module is taught</td><td colspan="3">Courses</td><td>ID</td><td>Semester</td></tr>
<tr><td colspan="3">- Electromechanical Workshop</td><td>EQ1010</td><td>1</td></tr>
<tr><td colspan="3">- Technical Drawing</td><td>MG2030</td><td>2</td></tr>
<tr><td>Person responsible for the Module</td><td colspan="5">- Juan Chacón</td></tr>
<tr><td>Lecturers</td><td colspan="5">- Juan Chacón
- Fernando Huayna</td></tr>
<tr><td>Language</td><td colspan="5">Spanish</td></tr>
<tr><td>Relation to curriculum</td><td colspan="5">Compulsory</td></tr>
<tr><td>Type of teaching, contact hours</td><td colspan="5">Contact hours and class size separately for each teaching method: lecture, lesson, practical, project, seminar, etc.
<table>
<tr><th>Nr</th><th>Courses ID</th><th>Contact hours per week</th><th>Teaching Method</th><th>Class Size</th></tr>
<tr><td>1</td><td>EQ1010</td><td>3.0</td><td>Workshop</td><td>20 students</td></tr>
<tr><td>2</td><td>MG2030</td><td>2.0</td><td>Lecture</td><td>40 students</td></tr>
</table></td></tr>
<tr><td>Workload</td><td colspan="5">(Estimated) workload, divided into contact hours (lecture, exercise, laboratory session, etc.) and private study, including examination preparation, specified in hours.
<table>
<tr><th>Nr</th><th>Courses</th><th>Contact Hours per week</th><th>Private Study per week</th><th>Total Workload</th><th>ECTS Credits</th></tr>
<tr><td>1</td><td>EQ1010</td><td>3.0</td><td>2.1</td><td>92</td><td>3</td></tr>
<tr><td>2</td><td>MG2030</td><td>2.0</td><td>2.2</td><td>76</td><td>3</td></tr>
</table></td></tr>
<tr><td>Requirements according to the examination regulations</td><td colspan="5">In order to pass each course of the module, student must obtain a minimal final grade of 11 (eleven). To compute the final grade, the fraction 0.5 or more is considered as a unit in favor the student. (Exam. Reg. 2013 Art. 21)</td></tr>
<tr><td>Recommended prerequisites</td><td colspan="5">Formal: None
Content: Mathematics knowledge, and computing skill</td></tr>
<tr><td>Module objectives/intended learning outcomes</td><td colspan="5">After having finished the module, students are able to:
Knowledge:
- Interpret drawings and mechanical, electrical, electronic and fluid installations and network diagrams.
- Drawing mechanical no complex systems and components using standardized norms.
- Choose and use tools in the mechanical workshop.
- Design and interpret electrical diagrams.
Skills:
- Produce drawings and mechanical, electrical, electronic and fluid installations and network diagrams
- Represent mechanical drawings using conventional drawing tools.
- Identify components and interpret characteristics of an electrical installation
Competences:
- Drawing mechanical components using a design methodology
- Install and maintain some mechanical equipment and important devices such as circuit breakers and others.</td></tr>
<tr><td>Content</td><td colspan="5">Electromechanical Workshop: Measurements and mechanical operations. Tools: drills, males, sweep; Joints and connections. Semi-visible electrical installation. Automatic controls. Perform maintenance on a three phase motor. Maintenance of an electric pump. Installation of electric pumps control.

Technical Drawing: Alphabetical lines. Standard writing. Labeled. Application of the types of lines. Standard scales: enlargement and reduction and natural scale. Standard sizing. ISO - ISO - e. sections projection A. Projection systems ISO-E. Completed section. Types of sections. Courts and sections. Basic electrical and</td></tr>
</table>

	electronic diagrams. Flowcharts.
Study and examination requirements and forms of examination	*Workshop: preparations with review, reports* *Lecture: partial written tests and final written exam*
Media employed	*Blackboard, slides, beamer presentations, demonstration of lab examples and experiments, workshop development tools and equipment*
Reading list	- *Equipo Técnico Edebé (1981). Tecnología mecánica 1. Barcelona: EDEBE. (620.1/E/t.1)* - *Gil Espinosa, Juan Carlos (1999). Manual de Mecánica Industrial. Madrid: Cultural. (620.1/G48M).* - *Hübscher, Heinrich (1983). Electrotecnia, curso elemental. Barcelona: Reverté. (621.3/H85E)* - *Mileaf , Harry (1989). Electricidad. México D.F.: Limusa. (621.3/M57/t.1), (621.3/M57/t.2), (621.3/M57/t.3), (621.3/M57/t.4), (621.3/M57/t.5), (621.3/M57/t.6), (621.3/M57/t.7)* - *Bachmann, Albert (1979) Dibujo técnico. Barcelona: Labor. (604.2/B13).* - *Giesecke, Frederick (1979) Dibujo técnico. México D.F.: Limusa (604.2/G4).* - *GTZ (1981) Dibujo técnico metal 1. Curso básico con pruebas. Eschborn: GTZ (604.2/M/1).* - *GTZ (1981) Dibujo técnico metal 2. Curso superior con pruebas. Eschborn: GTZ (604.2/M/2).*

Mathematics Module

<table>
<tr><td>Degree Program</td><td colspan="5">Chemical and Metallurgical Processes</td></tr>
<tr><td>Module designation</td><td colspan="5">Mathematics</td></tr>
<tr><td>Module level, if applicable</td><td colspan="5"></td></tr>
<tr><td>Code, if applicable</td><td colspan="5">QM-12</td></tr>
<tr><td rowspan="3">Courses and Semester(s) in which the module is taught</td><td colspan="3">Courses</td><td>ID</td><td>Semester</td></tr>
<tr><td colspan="3">- Mathematics I</td><td>GG1010</td><td>1</td></tr>
<tr><td colspan="3">- Mathematics II</td><td>GG2810</td><td>2</td></tr>
<tr><td>Person responsible for the Module</td><td colspan="5">- Gerald Cuzcano</td></tr>
<tr><td>Lecturers</td><td colspan="3">- Gerald Cuzcano
- Xyoby Chávez
- Rafael Enciso</td><td colspan="2">- José Fernández
- Alexander Peña
- Ernesto Zeña</td></tr>
<tr><td>Language</td><td colspan="5">Spanish</td></tr>
<tr><td>Relation to curriculum</td><td colspan="5">Compulsory</td></tr>
<tr><td>Type of teaching, contact hours</td><td colspan="5">Contact hours and class size separately for each teaching method: lecture, lesson, practical, project, seminar, etc.
<table>
<tr><th>Nr</th><th>Courses ID</th><th>Contact hours per week</th><th>Teaching Method</th><th>Class Size</th></tr>
<tr><td>1</td><td>GG1010</td><td>6.0</td><td>Lecture</td><td>40 students</td></tr>
<tr><td>2</td><td>GG2810</td><td>6.0</td><td>Lecture</td><td>40 students</td></tr>
</table></td></tr>
<tr><td>Workload</td><td colspan="5">(Estimated) workload, divided into contact hours (lecture, exercise, laboratory session, etc.) and private study, including examination preparation, specified in hours.
<table>
<tr><th>Nr</th><th>Courses</th><th>Contact Hours per week</th><th>Private Study per week</th><th>Semester Workload</th><th>ECTS Credits</th></tr>
<tr><td>1</td><td>GG1010</td><td>6.0</td><td>3.3</td><td>167</td><td>6</td></tr>
<tr><td>2</td><td>GG2810</td><td>6.0</td><td>4.3</td><td>185</td><td>6</td></tr>
</table></td></tr>
<tr><td>Requirements according to the examination regulations</td><td colspan="5">In order to pass each course of the module, student must obtain a minimal final grade of 11 (eleven). To compute the final grade, the fraction 0.5 or more is considered as a unit in favor the student. (Exam. Reg. 2013 Art. 21)</td></tr>
<tr><td>Recommended prerequisites</td><td colspan="5">Formal: None
Content: Elementary Mathematics skills</td></tr>
<tr><td>Module objectives/intended learning outcomes</td><td colspan="5">After having finished the module, students are able to:
Knowledge:
- Analyze situations using science and technology knowledge of analytic geometry, differential and integral calculus.
Skills:
- Select and apply properties of differential and integral calculus to solve problems in science and technology.
Competences:
- Formulate possible solutions to problems of science and technology by analyzing and interpreting data results from the mathematical point of view.</td></tr>
<tr><td>Content</td><td colspan="5">Mathematics I: Equations and systems of equations. Cartesian plane. The equation of the straight line. Equation of the circumference. Equation of the parabola. Equation of the ellipse. Equation of the ellipse. Inequalities. Functions. Introduction to the calculus and to the limit concept. Indeterminate limits. Continuity of a function. Trigonometric functions. Trigonometric limits. Application of functions in Physics. Definition of the derivative of a function. Application of the derivative of a function. Derivatives of a function. Derivatives of some special functions and the chain rule. Implicit derivative. The antiderivative and the indefinite integral. Methods of integration: by parts and by algebraic substitution. Integration by trigonometric substitution. Methods of integration: By trigonometric substitution. Definite integral. Calculus of areas.

Mathematics II: Limits and continuity. Asymptotes and graphs of functions. Derivative and motion. Differentials. Maximum and minimum. Flat region area.</td></tr>
</table>

	Length of a curve. Surface of revolution. Center of mass. Application problems. Volume of solids. Descriptive statistics. Fundamentals. Data presentation. Distribution of frequencies. Graphs. Application problems. Data Description. Measures of central tendency. Application problems. Bivariate tables. Combinatory analysis. Probability of an event. Calculation of probabilities. Normal distribution of probabilities. Selection of a sample. Rubric: Case analysis on the application of statistical techniques.
Study and examination requirements and forms of examination	*partial written tests and final written exam.*
Media employed	*Blackboard, slides, beamer presentations, demonstration of lab examples and experiments, lab development tools and equipment.*
Reading list	- *Berman, Simon L. (1974). Calculus for the nonphysical science. New York: Richart and Winston. (515/B47)* - *Haeussler, Ernest F. (2008). Matemáticas para la administración y economía. México D.F.: Iberoamericana (510/H25/2008).* - *Larson, Ron (2006). Cálculo. México D.F: McGraw-Hill (515/L25).* - *Neuhauser, Claudia (2004). Matemáticas para ciencias. Madrid: Prentice Hall (510/N47M).* - *Pinzón, Álvaro (1973). Cálculo I - difererencial. México D.F.:Harla (515/P59).* - *Waner, Stefan (2002). Cálculo aplicado. Madrid: Paraninfo (515/W23).* - *Davis, Linda (1990). Technical mathematics with calculus. Ohio: Merrill (510/D32).*

Physics Module

<table>
<tr><td>Degree Program</td><td colspan="5">Chemical and Metallurgical Processes</td></tr>
<tr><td>Module designation</td><td colspan="5">Physics</td></tr>
<tr><td>Module level, if applicable</td><td colspan="5"></td></tr>
<tr><td>Code, if applicable</td><td colspan="5">QM-13</td></tr>
<tr><td rowspan="3">Courses and Semester(s) in which the module is taught</td><td colspan="3">Courses</td><td>ID</td><td>Semester</td></tr>
<tr><td colspan="3">- Physics I</td><td>MG1010</td><td>1</td></tr>
<tr><td colspan="3">- Physics II</td><td>MG2010</td><td>2</td></tr>
<tr><td>Person responsible for the Module</td><td colspan="5">- Silvia Espinoza</td></tr>
<tr><td>Lecturers</td><td colspan="3">- Silvia Espinoza
- Jerson Araos
- Nicolás Herencia</td><td colspan="2">- Carlos Soca
- Penélope Vargas</td></tr>
<tr><td>Language</td><td colspan="5">Spanish</td></tr>
<tr><td>Relation to curriculum</td><td colspan="5">Compulsory</td></tr>
<tr><td>Type of teaching, contact hours</td><td colspan="5">Contact hours and class size separately for each teaching method: lecture, lesson, practical, project, seminar, etc.
<table>
<tr><th>Nr</th><th>Courses ID</th><th>Contact hours per week</th><th>Teaching Method</th><th>Class Size</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">MG1010</td><td>3.0</td><td>Lecture</td><td>40 students</td></tr>
<tr><td>1.5</td><td>Laboratory</td><td>20 students</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">MG2010</td><td>3.0</td><td>Lecture</td><td>40 students</td></tr>
<tr><td>1.5</td><td>Laboratory</td><td>20 students</td></tr>
</table></td></tr>
<tr><td>Workload</td><td colspan="5">(Estimated) workload, divided into contact hours (lecture, exercise, laboratory session, etc.) and private study, including examination preparation, specified in hours.
<table>
<tr><th>Nr</th><th>Courses</th><th>Contact Hours per week</th><th>Private Study per week</th><th>Semester Workload</th><th>ECTS Credits</th></tr>
<tr><td>1</td><td>MG1010</td><td>4.5</td><td>3.1</td><td>137</td><td>5.0</td></tr>
<tr><td>2</td><td>MG2010</td><td>4.5</td><td>3.6</td><td>146</td><td>5.0</td></tr>
</table></td></tr>
<tr><td>Requirements according to the examination regulations</td><td colspan="5">In order to pass each course of the module, student must obtain a minimal final grade of 11 (eleven). To compute the final grade, the fraction 0.5 or more is considered as a unit in favor the student. (Exam. Reg. 2013 Art. 21)</td></tr>
<tr><td>Recommended prerequisites</td><td colspan="5">Formal: None
Content: Elementary Mathematics knowledge, and computing skills</td></tr>
<tr><td>Module objectives/intended learning outcomes</td><td colspan="5">After having finished the module, students are able to:
Knowledge:
- Analyze and evaluate the application of the basic principles governing the phenomena of classical physics.
Skills:
- Apply the basic principles governing the phenomena of classical physics to specific situations and associated with real situations.
Competences:
- Reasoned argument in oral and written form, using scientific language correctly, on situations or problems related to the experimental sciences applied to your professional future.</td></tr>
<tr><td>Content</td><td colspan="5">Physics I: Thermometry. Expansion. Heat. Calorimetry. Phase change. Thermal balance. Heat transfer. Thermodynamics. Thermal expansion of solids. Thermodynamic processes. Zeroth law, first and second laws. Thermodynamic laws. Simple Harmonic Motion (SHM). Energy in SHM. Simple pendulum. Damped and forced movement. Mechanical resonance. Waves on a string. Melde's Experiment. Forced Harmonic Motion. Waves. Stationary waves. Sound. Doppler effect. Optics. Reflection, refraction of light. Geometrical Optics. Mirrors and lenses.

Physics II: Physical Magnitudes. Vectors. Sum of vectors. Components of vectors. Unit Vectors. Statics. Force. Newton's First and Third Laws. Free body diagrams.</td></tr>
</table>

	Representation of the forces existing in a body or system. Concurrent forces. First condition of equilibrium. Applications. Force or torque moment. Second condition of equilibrium. Kinematics. Uniform linear movement. Acceleration. Uniform linear motion with varied velocity. Free Fall. Gravity. Compound movement. Applications of circular movement. Dynamics. Newton's Second Law. Applications of dynamics. Friction. Friction in solids. Mechanical work. Power. Energy Conservation. Efficiency.
Study and examination requirements and forms of examination	- *Practical / laboratory: preparations with review, functional projects, lab reports* - *Lecture: partial written tests and final written exam.*
Media employed	*Blackboard, slides, beamer presentations, demonstration of lab examples and experiments, lab development tools and equipment.*
Reading list	- Bueche Frederick J. (2007) Física General. México D.F.: McGraw-Hill (530/B88/2007) - Sears, Francis W. (2004). Física universitaria. México D.F.: McGraw-Hill (530/S31/2004) - Serway, Raymond A. (1998). Física. México D.F.: McGraw - Hill. (530/S42F)

Fundamentals of Electrical Technology Module

<table>
<tr><td>Degree Program</td><td colspan="5">Chemical and Metallurgical Processes</td></tr>
<tr><td>Module designation</td><td colspan="5">Fundamentals of Electrical Technology</td></tr>
<tr><td>Module level, if applicable</td><td colspan="5"></td></tr>
<tr><td>Code, if applicable</td><td colspan="5">QM-14</td></tr>
<tr><td rowspan="3">Courses and Semester(s) in which the module is taught</td><td colspan="3">Courses</td><td>ID</td><td>Semester</td></tr>
<tr><td colspan="3">- Electricity</td><td>EG1010</td><td>1</td></tr>
<tr><td colspan="3">- Electronics</td><td>AG2010</td><td>2</td></tr>
<tr><td>Person responsible for the Module</td><td colspan="5">- Carlos Ortiz</td></tr>
<tr><td>Lecturers</td><td colspan="3">- Carlos Ortiz
- Dennis Chávarry
- Carlos Cuba
- Francisco Fernández</td><td colspan="2">- José Miranda
- Lennant Rojas
- César Santos</td></tr>
<tr><td>Language</td><td colspan="5">Spanish</td></tr>
<tr><td>Relation to curriculum</td><td colspan="5">Compulsory</td></tr>
<tr><td>Type of teaching, contact hours</td><td colspan="5">Contact hours and class size separately for each teaching method: lecture, lesson, practical, project, seminar, etc.
<table>
<tr><th>Nr</th><th>Courses ID</th><th>Contact hours per week</th><th>Teaching Method</th><th>Class Size</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">EG1010</td><td>2.0</td><td>Lecture</td><td>40 students</td></tr>
<tr><td>3.0</td><td>Laboratory</td><td>20 students</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">AG2010</td><td>2.0</td><td>Lecture</td><td>30 students</td></tr>
<tr><td>1.5</td><td>Practical</td><td>20 students</td></tr>
</table></td></tr>
<tr><td>Workload</td><td colspan="5">(Estimated) workload, divided into contact hours (lecture, exercise, laboratory session, etc.) and private study, including examination preparation, specified in hours.
<table>
<tr><th>Nr</th><th>Courses</th><th>Contact Hours per week</th><th>Private Study per week</th><th>Semester Workload</th><th>ECTS Credits</th></tr>
<tr><td>1</td><td>EG1010</td><td>5.0</td><td>3.1</td><td>146</td><td>5</td></tr>
<tr><td>2</td><td>AG2010</td><td>3.5</td><td>4.0</td><td>135</td><td>5</td></tr>
</table></td></tr>
<tr><td>Requirements according to the examination regulations</td><td colspan="5">In order to pass each course of the module, student must obtain a minimal final grade of 11 (eleven). To compute the final grade, the fraction 0.5 or more is considered as a unit in favor the student. (Exam. Reg. 2013 Art. 21)</td></tr>
<tr><td>Recommended prerequisites</td><td colspan="5">Formal: None
Content: Elementary Mathematics knowledge</td></tr>
<tr><td>Module objectives/intended learning outcomes</td><td colspan="5">After having finished the module, students are able to:
Knowledge:
- Recognize constituent parts in dc and ac electrical circuits and electrical machines.
- Recognize parameters and operation principles of single-phase and three-phase electrical systems.
Skills:
- Evaluate electrical parameters and analyze their behavior using equivalent circuit, phasorial calculation and computer applications.
Competences:
- Install basic electrical circuits and analyze the behavior of electrical parameters in operational or fault conditions, using measuring instruments and performing security procedures.</td></tr>
<tr><td>Content</td><td colspan="5">Electricity: Fundamental parameters of Electricity. Matter, atom, electrical charge, voltage generation. Electrical circuits. Voltage. Resistance. Electrical current. Fundamental Laws. Ohm’s Law. Second and first Kirchoff’s law. Power, energy and efficiency. Electrical Power. Efficiency. Electrical energy. Charge diagram. Magnetic field and electric field. Electromagnetism. Alternating current. Sinusoidal wave. Ohm’s law in AC. Series AC circuit. Parallel AC circuit. Power in AC. Active power. Reactive power. Apparent power. Three-phase</td></tr>
</table>

	circuits. Star connection. Triangle connection. Three-phase power. Electrical protection. Fuses. Thermomagnetic. Differentials. ***Electronics**: Introduction to Electronics. Semiconductor diodes. Application of semiconductor diodes. DC voltage sources. Basic calculations in a DC voltage source* *The bipolar transistor. Basic calculations in the BJT transistor. Thyristors. Optoelectronics. Integrated circuits. Digital Logics and Circuits. Industrial Digital Systems.*
Study and examination requirements and forms of examination	- *Practical / laboratory: preparations with review, functional projects, lab reports* - *Lecture: partial written tests and final written exam.*
Media employed	*Blackboard, slides, beamer presentations, demonstration of lab examples and experiments, lab development tools and equipment.*
Reading list	- *Alcalde San Miguel, Pablo.(1998) Electrotecnia. Equipos e instalaciones electrotécnicas. Madrid: Paraninfo. (621.3 /A35).* - *Dorf, Richard C. (2006) Circuitos eléctricos. México D.F.: Alfaomega. (621.3C / D92C).* - *García Trasancos, José (1998) Electrotecnia. Barcelona: Reverté. (621.3/G25E).* - *Mileaf, Harry (1989) Curso práctico de electricidad. Vol. 1. México D.F.: Ciencia y Técnica. (621.3/M57/v.1)* - *Mileaf, Harry (1989) Curso práctico de electricidad. Vol. 2. México D.F.: Ciencia y Técnica. (621.3/M57/v.2)* - *Boylestad, Robert L. (2003). Electrónica: Teoría de circuitos. México D.F.: Prentice Hall (621.381/B78/2003.)* - *Floyd, Thomas (2006) Dispositivos electrónicos. Mexico D.F..Limusa (621.381/F59D).* - *Floyd, Thomas (2006) Fundamentos de sistemas digitales. New Jersey.Pearson Prentice Hall (621.381/F59).* - *Malvino, Albert Paul (2000) Principios de electrónica. Madrid: McGraw-Hill. (621.381/M19/2000).* - *Savant, C.J. (1992) Diseño electrónico.Circuitos y sistemas. Wilmington: Addison Wesley (621.381C/S25).*

Values and Culture Module

<table>
<tr><td>Degree Program</td><td colspan="5">Chemical and Metallurgical Processes</td></tr>
<tr><td>Module designation</td><td colspan="5">Values and Culture</td></tr>
<tr><td>Module level, if applicable</td><td colspan="5"></td></tr>
<tr><td>Code, if applicable</td><td colspan="5">QM-15</td></tr>
<tr><td rowspan="3">Courses and Semester(s) in which the module is taught</td><td colspan="3">Courses</td><td>ID</td><td>Semester</td></tr>
<tr><td colspan="3">- Attitudes and Values</td><td>GG1030</td><td>1</td></tr>
<tr><td colspan="3">- National and International Reality</td><td>GG2030</td><td>2</td></tr>
<tr><td>Person responsible for the Module</td><td colspan="5">- Enit Vivanco</td></tr>
<tr><td>Lecturers</td><td colspan="5">- Enit Vivanco
- Luisa Palomino</td></tr>
<tr><td>Language</td><td colspan="5">Spanish</td></tr>
<tr><td>Relation to curriculum</td><td colspan="5">Compulsory</td></tr>
<tr><td>Type of teaching, contact hours</td><td colspan="5">Contact hours and class size separately for each teaching method: lecture, lesson, practical, project, seminar, etc.
<table>
<tr><th>Nr</th><th>Courses ID</th><th>Contact hours per week</th><th>Teaching Method</th><th>Class Size</th></tr>
<tr><td>1</td><td>GG1030</td><td>2.0</td><td>Lecture</td><td>40 students</td></tr>
<tr><td>2</td><td>GG2030</td><td>2.0</td><td>Lecture</td><td>40 students</td></tr>
</table></td></tr>
<tr><td>Workload</td><td colspan="5">(Estimated) workload, divided into contact hours (lecture, exercise, laboratory session, etc.) and private study, including examination preparation, specified in hours.
<table>
<tr><th>Nr</th><th>Courses</th><th>Contact Hours per week</th><th>Private Study per week</th><th>Semester Workload</th><th>ECTS Credits</th></tr>
<tr><td>1</td><td>GG1030</td><td>2.0</td><td>1.4</td><td>61</td><td>2</td></tr>
<tr><td>2</td><td>GG2030</td><td>2.0</td><td>1.3</td><td>59</td><td>2</td></tr>
</table></td></tr>
<tr><td>Requirements according to the examination regulations</td><td colspan="5">In order to pass each course of the module, student must obtain a minimal final grade of 11 (eleven). To compute the final grade, the fraction 0.5 or more is considered as a unit in favor the student. (Exam. Reg. 2013 Art. 21)</td></tr>
<tr><td>Recommended prerequisites</td><td colspan="5">Formal: None
Content: None</td></tr>
<tr><td>Module objectives/intended learning outcomes</td><td colspan="5">After having finished the module, students are able to:
Knowledge:
- Recognize the importance of the practice of values, cultural diversity and develop a personal life plan.
- Analyze the components of national and international reality and proposes alternative solutions to the cyclical problem, based on ethical and moral principles that contribute to the development of society.
Skills:
- Value himself, recognize their emotions and feelings, and making decisions assuming a positive attitude, and an active and responsible behavior.
- Interpret and analyze problems of socio-cultural, economic and political reality at national and international levels, identifying potential opportunities in Peru and its insertion in the world market.
Competences:
- Display a positive attitude towards values, recognize and accept its culture, respect the diversity of its environment.
- Analyze the current situations in the components: political, economic, social and cultural, assuming a critical and reflective attitude on the national and international reality.</td></tr>
<tr><td>Content</td><td colspan="5">Attitudes and Values: Academic regulations and rules guiding the institution. Study methods and habits. Values, positive attitudes, anti-values and consequences. Self-esteem. Personal Image. Decision-making. Cultural diversity, interculturality. Rubric – Analysis of presentations proposed in order that students can recognize and accept their culture and respect the diversity. Anxiety, tension, stress and self-control techniques. Intelligent behaviour, emotional intelligence. Thought, cognitive skills</td></tr>
</table>

	Memory and learning. Life Plan. Courtesy rules. Leadership. ***National and International Reality**: National and international reality. Spatial reality. Ecology and environment. Organization of group assignments. Spatial reality. Peruvian territory. Spatial reality. National and international geo-strategy and geo-politics. Social reality. National cultural diversity. Transnational migratory process. Rubric – Analysis of the migratory process. Social reality. National identity. Social reality. Worldwide perception of Peru. Political reality. Peruvian State: Political and administrative organization. Evaluation of research progress. Political reality. Peruvian decentralization process. Democracy and political parties. Economic reality. Peruvian economic model. International economic blocks. Business Outlook in Peru. Social responsibility. Economic reality: Peru as a possibility. Productive clusters and holding. Development of micro, small and medium business in Peru*
Study and examination requirements and forms of examination	*Lecture: partial written tests and final written exam.*
Media employed	*Blackboard, slides, beamer presentations, demonstration of lab examples and experiments, lab development tools and equipment.*
Reading list	- *Berumen de los Santos, Nora María (2001). Ética del ejercicio profesional. México D.F.: Continental (179.9/B45)* - *Gomez, María Teresa (1997). Cómo educar en valores. Madrid: s.n. (179.9/G62)* - *Olcese Salvatecci, Alfieri (2002). Cómo estudiar con éxito: Técnicas y hábitos para aprender mejor. México D.F.: Alfaomega (371.302/O21)* - *Rodriguez Estrada, Mauro (2006). Aprendizaje creativo continuo. Cuando aprender es emprender. México D.F.: Trillas (370.157/R75)* - *Towers, Marc (2006). Venza a su peor enemigo: Autoestima. Madrid: Fundación Confemetal (155.2/T77)* - *Agenda Perú, Caretas y PUCP (2001) Los 50 y tantos libros que todo peruano culto debe leer. Lima: Caretas: PUCP.* - *Contreras, Carlos (2000). Historia del Perú Contemporáneo. Lima: Instituto de Estudios Peruano. (985/C81)* - *Matos Mar, José (2005). Desborde popular y crisis del estado, veinte años después. Lima: s.n. (306.2/M28)* - *Raich, Mario (2008). Más allá. Empresa y sociedad en transformación. Lima: Tecsup. (658.3A/R18)* - *Soto, Hernando de (2000). El ministerio del capital. Porqué el capitalismo triunfa en occidente y fracasa en el resto del mundo. (330.122/S71)*

Communications Module

<table>
<tr><td>Degree Program</td><td colspan="5">Chemical and Metallurgical Processes</td></tr>
<tr><td>Module designation</td><td colspan="5">Communications</td></tr>
<tr><td>Module level, if applicable</td><td colspan="5"></td></tr>
<tr><td>Code, if applicable</td><td colspan="5">QM-16</td></tr>
<tr><td>Courses and Semester(s) in which the module is taught</td><td colspan="5">
<table>
<tr><th>Courses</th><th>ID</th><th>Semester</th></tr>
<tr><td>- Communications I</td><td>GG1020</td><td>1</td></tr>
<tr><td>- Communications II</td><td>GG2820</td><td>2</td></tr>
<tr><td>- Successful Presentations</td><td>GG2910</td><td>3</td></tr>
</table>
</td></tr>
<tr><td>Person responsible for the Module</td><td colspan="5">- Elisa Montoya</td></tr>
<tr><td>Lecturers</td><td colspan="5">- Elisa Montoya
- Susan Cuentas
- Mónica Jiménez
- Miguel Ortiz
- Julia Torres</td></tr>
<tr><td>Language</td><td colspan="5">Spanish</td></tr>
<tr><td>Relation to curriculum</td><td colspan="5">Compulsory</td></tr>
<tr><td>Type of teaching, contact hours</td><td colspan="5">Contact hours and class size separately for each teaching method: lecture, lesson, practical, project, seminar, etc.
<table>
<tr><th>Nr</th><th>Courses ID</th><th>Contact hours per week</th><th>Teaching Method</th><th>Class Size</th></tr>
<tr><td>1</td><td>GG1020</td><td>6.0</td><td>Lecture</td><td>40 students</td></tr>
<tr><td>2</td><td>GG2820</td><td>5.0</td><td>Lecture</td><td>40 students</td></tr>
<tr><td>3</td><td>GG2910</td><td>2.0</td><td>Lecture</td><td>40 students</td></tr>
</table>
</td></tr>
<tr><td>Workload</td><td colspan="5">(Estimated) workload, divided into contact hours (lecture, exercise, laboratory session, etc.) and private study, including examination preparation, specified in hours.
<table>
<tr><th>Nr</th><th>Courses</th><th>Contact Hours per week</th><th>Private Study per week</th><th>Semester Workload</th><th>ECTS Credits</th></tr>
<tr><td>1</td><td>GG1020</td><td>6.0</td><td>1.4</td><td>133</td><td>4</td></tr>
<tr><td>2</td><td>GG2820</td><td>5.0</td><td>1.8</td><td>122</td><td>4</td></tr>
<tr><td>3</td><td>GG2910</td><td>2.0</td><td>1.4</td><td>61</td><td>2</td></tr>
</table>
</td></tr>
<tr><td>Requirements according to the examination regulations</td><td colspan="5">In order to pass each course of the module, student must obtain a minimal final grade of 11 (eleven). To compute the final grade, the fraction 0.5 or more is considered as a unit in favor the student. (Exam. Reg. 2013 Art. 21)</td></tr>
<tr><td>Recommended prerequisites</td><td colspan="5">Formal: None
Content: Entry-level skills in communication and computing skills.</td></tr>
<tr><td>Module objectives/intended learning outcomes</td><td colspan="5">After having finished the module, students are able to:
Knowledge:
- Categorize and interpret ideas, data and explicit and implicit concepts in a text given the context in which it was generated and in which it was received.
- Base his opinion with clarity, fluency and coherence using verbal and non-verbal resources.
- Produce texts according to the specific purpose of each communication.
Skills:
- Build different types of texts.
- Select the appropriate type of argument to support their position.
- Discriminate the relevant from the complement of any text.
Competences:
- Communicate in oral or written form the themes of his profession with informative and argumentative base, applying appropriate resources to facilitate the expression of speech in specialized and non-specialized audiences.</td></tr>
<tr><td>Content</td><td colspan="5">Communication I: Human communication and information in contemporary society. Reading as a tool for communication. Text analysis: organization and integration of the text. Annotations and concept maps Bibliographical citations.</td></tr>
</table>

	APA format. Writing technical reports. Spelling rules. Capitalization. General accentuation. Special cases of accentuation. Diacritical marks. Sentence. Punctuation marks. Connectors. Paragraph. Condensed description. E-mail. Commercial writing. Communicating orally through the speech. Oral communication. ***Communication II**: Communication in organizations. Assertive communication and characteristics. Techno scientific language. Technical description of the workshop. Reading comprehension. Writing. Reading comprehension. Text production. Oral comprehension and expression. Types of discussion. Argumentation as a foundation for controversy and discussion. Argumentative presentation. Administrative writing.* ***Successful presentations**: Competences in-demand today. The first contact. Individual and shared presentations. The psychological preparation. Stage fright. Presentation design. Preparation of training designs. How to improve your behaviour when you give a presentation. Emphasis and motivation in presentations. Self-confidence. Use of techniques. Presentation of techniques. Audiovisual aids. Institutional presentation. Institutional presentation. Communication styles. Formal aspects of conferences. Criteria to evaluate presentations before an audience. Presentation of topics assigned using appropriate techniques.*
Study and examination requirements and forms of examination	- *Practical: oral presentations* - *Lecture: partial written tests and final written exam.*
Media employed	*Blackboard, slides, beamer presentations, demonstration of lab examples and experiments, lab development tools and equipment.*
Reading list	- *AGUIRRE, Mauricio y ESTRADA, Christian. (2007). Redactar en la universidad. Conceptos y técnicas fundamentales. Lima: UPC.BUSTOS, Juan. (2005). A escribir se aprende escribiendo. Madrid: Comunidad de Madrid Consejería de Educación.CHOMSKY, Noam. (2006). Nuestro conocimiento del lenguaje humano. Santiago de Chile: Edición Bilingüe.CLAVIJO Olarte, Amparo. (2006). Prácticas innovadoras de lectura y escritura. Bogotá: Universidad Distrital Francisco José de Caldas.REAL ACADEMIA ESPAÑOLA. (2010) Ortografía de la lengua española. Madrid: Espasa.* - *AGUIRRE, Mauricio y ESTRADA, Christian. (2007). Redactar en la universidad. Conceptos y técnicas fundamentales. Lima: UPC.* - *BUSTOS, Juan. (2005). A escribir se aprende escribiendo. Madrid: Comunidad de Madrid Consejería de Educación.* - *CHOMSKY, Noam. (2006). Nuestro conocimiento del lenguaje humano. Santiago de Chile: Edición Bilingüe.* - *CLAVIJO Olarte, Amparo. (2006). Prácticas innovadoras de lectura y escritura. Bogotá: Universidad Distrital Francisco José de Caldas* - *REAL ACADEMIA ESPAÑOLA. (2010) Ortografía de la lengua española. Madrid: Espasa.* - *Del Pozo Delgado, Pilar. (2007) Formación de formadores. Madrid: Pirámide (658.3124/D49)* - *Robbins, Stephen P. (2004) Comportamiento organizacional. Mexico D.F.: Pearson Education. (658.3A/R71).* - *Schermerhorn, John R. (2006). Administración. Mexico D.F.: Limusa. (658.3A/S29)*

Quality and Safety Module

<table>
<tr><td>Degree Program</td><td colspan="5">Chemical and Metallurgical Processes</td></tr>
<tr><td>Module designation</td><td colspan="5">Quality and Safety</td></tr>
<tr><td>Module level, if applicable</td><td colspan="5"></td></tr>
<tr><td>Code, if applicable</td><td colspan="5">QM-17</td></tr>
<tr><td rowspan="3">Courses and Semester(s) in which the module is taught</td><td colspan="3">Courses</td><td>ID</td><td>Semester</td></tr>
<tr><td colspan="3">- Continuous Improvement</td><td>GG3020</td><td>3</td></tr>
<tr><td colspan="3">- Safety, Health and Environment</td><td>GG4010</td><td>4</td></tr>
<tr><td>Person responsible for the Module</td><td colspan="5">- Luis Peña</td></tr>
<tr><td>Lecturers</td><td colspan="5">- Luis Peña
- Segundo Jiménez</td></tr>
<tr><td>Language</td><td colspan="5">Spanish</td></tr>
<tr><td>Relation to curriculum</td><td colspan="5">Compulsory</td></tr>
<tr><td>Type of teaching, contact hours</td><td colspan="5">Contact hours and class size separately for each teaching method: lecture, lesson, practical, project, seminar, etc.
<table>
<tr><th>Nr</th><th>Courses ID</th><th>Contact hours per week</th><th>Teaching Method</th><th>Class Size</th></tr>
<tr><td>1</td><td>GG3020</td><td>2.0</td><td>Lecture</td><td>40 students</td></tr>
<tr><td>2</td><td>GG4010</td><td>2.0</td><td>Lecture</td><td>40 students</td></tr>
</table></td></tr>
<tr><td>Workload</td><td colspan="5">(Estimated) workload, divided into contact hours (lecture, exercise, laboratory session, etc.) and private study, including examination preparation, specified in hours.
<table>
<tr><th>Nr</th><th>Courses</th><th>Contact Hours per week</th><th>Private Study per week</th><th>Semester Workload</th><th>ECTS Credits</th></tr>
<tr><td>1</td><td>GG3020</td><td>2.0</td><td>1.3</td><td>59</td><td>2</td></tr>
<tr><td>2</td><td>GG4010</td><td>2.0</td><td>2.2</td><td>76</td><td>3</td></tr>
</table></td></tr>
<tr><td>Requirements according to the examination regulations</td><td colspan="5">In order to pass each course of the module, student must obtain a minimal final grade of 11 (eleven). To compute the final grade, the fraction 0.5 or more is considered as a unit in favor the student. (Exam. Reg. 2013 Art. 21)</td></tr>
<tr><td>Recommended prerequisites</td><td colspan="5">Formal: None
Content: Basic Statistics knowledge and computing skills.</td></tr>
<tr><td>Module objectives/intended learning outcomes</td><td colspan="5">After having finished the module, students are able to:
Knowledge:
- Design basic model of continuous improvement and quality´s system
- Design basic structure of security, healthy and environment´s system
Skills:
- Use tools for continuous improvement of quality
- Use tools for evaluate personal and environment of risk
Competences:
- Propose, implement and evaluate the improvement actions in the quality´s system
- Evaluate the risks present in the workplace and suggests control measures</td></tr>
<tr><td>Content</td><td colspan="5">Continuous Improvement: Principles and foundations of quality. Foundations for continuous improvement. Methodology of operational excellence. Building understanding. Measurement and analysis. Generating solutions. Improving and controlling. Creating institutions. Continuous Improvement – Kaizen. Problem resolution methodology. Projects of improvement. ISO 9000: 2000 Standards Series. Integrated management systems. Rubric – Case analysis: Application of continuous improvement at a corporation. Implementation of a quality management model.

Safety, Health and Environment: Prevention of labor risks. Industrial safety. Prevention of labor risks. Industrial hygiene. Environment and Industrial Social Responsibility. Systems of health, safety and environment management and social responsibility. Regulations on health, safety and environment. Electrical hazards and risks of hydrocarbons. Identification of hazards, evaluation and risk control. Control of risks to health and safety. Personal protection equipment. Environmental risks control. Preparation for emergencies. Prevention and control of spillages and</td></tr>
</table>

	fire. Preparation for emergencies. First aids.
Study and examination requirements and forms of examination	*Lecture: partial written tests and final written exam.*
Media employed	*Blackboard, slides, beamer presentations, demonstration of lab examples and experiments, lab development tools and equipment.*
Reading list	- *Crosby, Philip B (2001) La calidad no cuesta: El arte de cerciorarse de la calidad. México D.F.: Continental (658.562/C91C)* - *Gutierrez Pulido, Humberto (2005). Calidad total y productividad. México D.F.: McGraw-Hill (658.562/G96P)* - *Imai, Masaki (1992). Kaizen, México D.F.: Continental (658.562/I41)* - *Imai, Masaki (1998) Cómo interpretar el Kaizan en el sitio de trabajo. Bogotá. Mc Graw-Hill (658.562/I4)* - *Polya, G. (2004). How to solve it. A new aspect of mathematical method. New Jersey / Princeton University Press (511/P75)* - *Grimaldi, John V. (1991) Manual de seguridad industrial. Bogotá: Alfaomega. (620.86/G82M)* - *Letayf, Jorge (1998). Seguridad, higiene y control ambiental. México D.F.: Mc Graw-Hill. (658.2/L52)* - *Ramírez Cavassa, César (2007). Seguridad industrial. Un enfoque integral. México D.F: Limusa. (620.86/R22)*

Basic English Module

<table>
<tr><td>Degree Program</td><td colspan="5">Chemical and Metallurgical Processes</td></tr>
<tr><td>Module designation</td><td colspan="5">Basic English</td></tr>
<tr><td>Module level, if applicable</td><td colspan="5"></td></tr>
<tr><td>Code, if applicable</td><td colspan="5">QM-18</td></tr>
<tr><td>Courses and Semester(s) in which the module is taught</td><td colspan="5">
<table>
<tr><th>Courses</th><th>ID</th><th>Semester</th></tr>
<tr><td>- English I</td><td>GG5010</td><td>5</td></tr>
<tr><td>- English II</td><td>GG6010</td><td>6</td></tr>
</table>
</td></tr>
<tr><td>Person responsible for the Module</td><td colspan="5">Milton Chuquiruna</td></tr>
<tr><td>Lecturer</td><td colspan="5">Milton Chuquiruna</td></tr>
<tr><td>Language</td><td colspan="5">English</td></tr>
<tr><td>Relation to curriculum</td><td colspan="5">Compulsory</td></tr>
<tr><td>Type of teaching, contact hours</td><td colspan="5">Contact hours and class size separately for each teaching method: lecture, lesson, practical, project, seminar, etc.
<table>
<tr><th>Nr</th><th>Courses ID</th><th>Contact hours per week</th><th>Teaching Method</th><th>Class Size</th></tr>
<tr><td>1</td><td>GG5010</td><td>6.0</td><td>Lecture</td><td>40 students</td></tr>
<tr><td>2</td><td>GG6010</td><td>6.0</td><td>Lecture</td><td>40 students</td></tr>
</table>
</td></tr>
<tr><td>Workload</td><td colspan="5">(Estimated) workload, divided into contact hours (lecture, exercise, laboratory session, etc.) and private study, including examination preparation, specified in hours.
<table>
<tr><th>Nr</th><th>Courses</th><th>Contact Hours per week</th><th>Private Study per week</th><th>Semester Workload</th><th>ECTS Credits</th></tr>
<tr><td>1</td><td>GG5010</td><td>6.0</td><td>1.4</td><td>133</td><td>4</td></tr>
<tr><td>2</td><td>GG6010</td><td>6.0</td><td>1.4</td><td>133</td><td>4</td></tr>
</table>
</td></tr>
<tr><td>Requirements according to the examination regulations</td><td colspan="5">In order to pass each course of the module, student must obtain a minimal final grade of 11 (eleven). To compute the final grade, the fraction 0.5 or more is considered as a unit in favor the student. (Exam. Reg. 2013 Art. 21)</td></tr>
<tr><td>Recommended prerequisites</td><td colspan="5">Formal: None
Content: Entry-level skills in communication</td></tr>
<tr><td>Module objectives/intended learning outcomes</td><td colspan="5">After having finished the module, students are able to:
Knowledge:
- Identify and effectively use Basic English structures in order to read, interpret and translate texts on general topics of increasing complexity.
Skills:
- Establish basic communication in English in oral and written form.
- Understanding and interpreting basic general English texts.
Competences:
- Read, translate and interpret English texts on basic general topics.
- Speaking in basic form using simple grammatical structures of English.</td></tr>
<tr><td>Content</td><td colspan="5">English I: People and places. You and yours. Everyday life. Loves and hates. Getting from A to B. Eating and drinking. Extraordinary lives. Fact or fiction. Buying and selling. Keeping in touch. Going places. Street life.

English II: The world around us. A weekend away. Learning for the future. Leisure and lifestyle. Important firsts. At rest, at work. Special occasions. Appearances. Time off. Ambitions and dreams. Countries and cultures. Old and new. Take Care.</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td colspan="5">Lecture: partial written tests, oral and written assignments and final written exam</td></tr>
<tr><td>Media employed</td><td colspan="5">Blackboard, slides, beamer presentations, demonstration of lab examples and experiments, lab development tools and equipment.</td></tr>
<tr><td>Reading list</td><td colspan="5">- Cutting Edge - Students´ Book, Workbook, Students´.
- Resource Bank, Mini-Dictionary and Student CD. Sarah.
- Cunningham & Moor Peter with Frances Eales.</td></tr>
</table>

Management Module

<table>
<tr><td>Degree Program</td><td colspan="5">Chemical and Metallurgical Processes</td></tr>
<tr><td>Module designation</td><td colspan="5">Management</td></tr>
<tr><td>Module level, if applicable</td><td colspan="5"></td></tr>
<tr><td>Code, if applicable</td><td colspan="5">QM-19</td></tr>
<tr><td>Courses and Semester(s) in which the module is taught</td><td colspan="5">
<table>
<tr><th>Courses</th><th>ID</th><th>Semester</th></tr>
<tr><td>- Maintenance Management</td><td>MG4010</td><td>4</td></tr>
<tr><td>- Project Management</td><td>GG5020</td><td>5</td></tr>
<tr><td>- Business Management</td><td>GG6020</td><td>6</td></tr>
</table>
</td></tr>
<tr><td>Person responsible for the Module</td><td colspan="5">- Edwin Ramos</td></tr>
<tr><td>Lecturers</td><td colspan="5">- David Maita
- Edwin Ramos
- Luis Peña</td></tr>
<tr><td>Language</td><td colspan="5">Spanish</td></tr>
<tr><td>Relation to curriculum</td><td colspan="5">Compulsory</td></tr>
<tr><td>Type of teaching, contact hours</td><td colspan="5">Contact hours and class size separately for each teaching method: lecture, lesson, practical, project, seminar, etc.
<table>
<tr><th>Nr</th><th>Courses ID</th><th>Contact hours per week</th><th>Teaching Method</th><th>Class Size</th></tr>
<tr><td>1</td><td>MG4010</td><td>3</td><td>Lecture</td><td>40 students</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">GG5020</td><td>2.0</td><td>Lecture</td><td>40 students</td></tr>
<tr><td>1.0</td><td>Laboratory</td><td>20 students</td></tr>
<tr><td>3</td><td>GG6020</td><td>2.0</td><td>Lecture</td><td>40 students</td></tr>
</table>
</td></tr>
<tr><td>Workload</td><td colspan="5">(Estimated) workload, divided into contact hours (lecture, exercise, laboratory session, etc.) and private study, including examination preparation, specified in hours.
<table>
<tr><th>Nr</th><th>Courses</th><th>Contact Hours per week</th><th>Private Study per week</th><th>Semester Workload</th><th>ECTS Credits</th></tr>
<tr><td>1</td><td>MG4010</td><td>3.0</td><td>1.4</td><td>79</td><td>3</td></tr>
<tr><td>2</td><td>GG5020</td><td>3.0</td><td>2.3</td><td>95</td><td>3</td></tr>
<tr><td>3</td><td>GG6020</td><td>2.0</td><td>3.2</td><td>94</td><td>3</td></tr>
</table>
</td></tr>
<tr><td>Requirements according to the examination regulations</td><td colspan="5">In order to pass each course of the module, student must obtain a minimal final grade of 11 (eleven). To compute the final grade, the fraction 0.5 or more is considered as a unit in favor the student. (Exam. Reg. 2013 Art. 21)</td></tr>
<tr><td>Recommended prerequisites</td><td colspan="5">Formal: None
Content: Quality tools, communication and computing skills</td></tr>
<tr><td>Module objectives/intended learning outcomes</td><td colspan="5">After having finished the module, students are able to:
Knowledge:
- Develop, plan, organize and manage human and material resources in a project.
- Plans, organize, direct and control the human and material resources of a business.
Skills:
- Use modern theories and methodologies for managing resources of a business.
Competences:
- Apply concepts and methodologies in the management of resources in an industrial and / or services business.</td></tr>
<tr><td>Content</td><td colspan="5">Maintenance Management: Relationship among maintenance, production and the equipment manufacturer. Stages in the management cycle. Equipment useful life. Maintenance planning and scheduling. Implementation of a maintenance system. Useful life cost. Technical and economic selection of fans and compressors. Specific costs in the useful life. Organization of maintenance and assignation of resources required for the activities. Main maintenance management indicators. Group presentation on management indicators. Financial and labour indicators. Design of</td></tr>
</table>

	a laboratory or workshop maintenance plan according to the manufacturer's information and the operational conditions. CMMS - Computerized management system. Processes, operations and components at industrial plants. Eliminating wasting. Poka- Yoke, Smed. ***Project Management**: Fundamental concepts related to projects. Identification of problems and improvement opportunities. Market research. Sales and incomes budget. Project engineering. Introduction to costs. Calculation of costs using proposed exercises. Sensitivity analysis – Differential costs. Laboratory costs. Budget of costs and investment. Expenses budget. Projected Financial statements. Projected cash flow. Financial assessment. Financial assessment. Planning the implementation. Diagrams. Planning the implementation: RED PERT-CPM. Follow-up and closing. Other project approaches. Real cases of improvement projects.* ***Business Management**: Administrative process. Strategic planning. Organizational structure. Legal and tax aspects of a business. Group case 1. Starting up a business Sales projection. Industrial marketing strategies. Aggregate planning. Production programming. Launching and production control. Rubric – Planning, programming and controlling the production in a business unit. Purchases, stocks and storage. Financial statements analysis. Administrative , operational and financial operators Stocks and financial operations. Rubric. Calculation and definition of cost in a business unit. Cost-volume-profit model. Financial analysis*
Study and examination requirements and forms of examination	- *Practical / laboratory: preparations with review, functional projects, lab reports and oral presentations* - *Lecture: partial written tests and final written exam.*
Media employed	*Blackboard, slides, beamer presentations, demonstration of lab examples and experiments, lab development tools and equipment.*
Reading list	- *Cotler, Mel A. (1994) Maintenance programming. New Jersey: Prentice Hall. (658.2/C85).* - *Goettsche, L.D. (1998) Maintenance of instruments and Systems. New York: s.n. (621.381I/G57)* - *González Fernández, Francisco Javier (2009). Teoría y práctica del mantenimiento industrial avanzado. Madrid: Fundación Confemetal (658.202/G71/2009)* - *Hartmann, Eward H. (1998) Cómo instalar con éxito el TPM en su empresa. A través del original proceso TPM. Lima: s.n. (658.2/H2T)* - *Levitt, Joel (2009). The handbook of maintenance management. New York: Industrial Press (658.202/L54)* - *Palmer, Doc (2006) Maintenance planning and scheduling handbook. New York: McGraw-Hill (658.202/P19)* - *Wireman, Terry (2005). Developing perfomance indicators for managing maintenance. New York: Industrial Press (658.2/W72D)* - *Amat, Joan María (2002) Control presupuestario. Barcelona: Gestión 2000. (658.1G/A52C).* - *Colmenar Santos, Antonio (2007). Gestión de proyectos con Microsoft Project 2007. México D.F.: Alfaomega (005.368PR/C75)* - *Domingo Ajenjo, Alberto (2005). Dirección y gestión de proyectos. Un enfoque práctico. México D.F.: Alfaomega - Rama (658.404/A33)* - *Gido, Jack (1999) Administración exitosa de proyectos. México D.F.: s.n. (658.404/G44)* - *Project Management Institute (2008). A guide to the project management body of knowledge: (PMBOK Guide). Atlanta: Project Management Institute (658.404/P87/2008)* - *Chase, Richard (2000) Administración de producción y operaciones. Manufactura y servicios. Bogotá: Mc Graw - Hill. (658.5P/CH526A)* - *Kotler, Philip (2006). Dirección de marketing. México D.F.: Pearson Educación (658.8/K11).* - *Porter, Michael E. (1997) Estrategia competitiva. Técnicas para el análisis de*

	los sectores industriales y de la competencia. México D.F.: Continental. (658.1G/P78) - *Ross, Stephen (2006) Fundamentos de finanzas corporativas. México D.F.: McGraw-Hill (658.15/R84)* - *Schermerhorn, John R. (2006) Administración. México D.F.: Limusa (658.3A/S29).*

Human Resources and Labor Market Module

<table>
<tr><td>Degree Program</td><td colspan="5">Chemical and Metallurgical Processes</td></tr>
<tr><td>Module designation</td><td colspan="5">Human Resources and Labor Market</td></tr>
<tr><td>Module level, if applicable</td><td colspan="5"></td></tr>
<tr><td>Code, if applicable</td><td colspan="5">QM-20</td></tr>
<tr><td>Courses and Semester(s) in which the module is taught</td><td colspan="3">Courses</td><td>ID</td><td>Semester</td></tr>
<tr><td></td><td colspan="3">- Decision-Making</td><td>GG4020</td><td>4</td></tr>
<tr><td></td><td colspan="3">- Human Resources</td><td>GG5040</td><td>5</td></tr>
<tr><td></td><td colspan="3">- Induction to Labor Market</td><td>GG6030</td><td>6</td></tr>
<tr><td>Person responsible for the Module</td><td colspan="5">Henry Anchante</td></tr>
<tr><td>Lecturers</td><td colspan="5">- Henry Anchante
- Luis León
- Diana Castillo</td></tr>
<tr><td>Language</td><td colspan="5">Spanish</td></tr>
<tr><td>Relation to curriculum</td><td colspan="5">Compulsory</td></tr>
<tr><td>Type of teaching, contact hours</td><td colspan="5">Contact hours and class size separately for each teaching method: lecture, lesson, practical, project, seminar, etc.
<table>
<tr><th>Nr</th><th>Courses ID</th><th>Contact hours per week</th><th>Teaching Method</th><th>Class Size</th></tr>
<tr><td>1</td><td>GG4020</td><td>2.0</td><td>Lecture</td><td>40 students</td></tr>
<tr><td>2</td><td>GG5040</td><td>3.0</td><td>Lecture</td><td>40 students</td></tr>
<tr><td>3</td><td>GG6030</td><td>2.0</td><td>Lecture</td><td>40 students</td></tr>
</table></td></tr>
<tr><td>Workload</td><td colspan="5">(Estimated) workload, divided into contact hours (lecture, exercise, laboratory session, etc.) and private study, including examination preparation, specified in hours.
<table>
<tr><th>Nr</th><th>Courses</th><th>Contact Hours per week</th><th>Private Study per week</th><th>Semester Workload</th><th>ECTS Credits</th></tr>
<tr><td>1</td><td>GG4020</td><td>2.0</td><td>2.1</td><td>76</td><td>2</td></tr>
<tr><td>2</td><td>GG5040</td><td>3.0</td><td>2.1</td><td>92</td><td>3</td></tr>
<tr><td>3</td><td>GG6030</td><td>2.0</td><td>1.5</td><td>63</td><td>2</td></tr>
</table></td></tr>
<tr><td>Requirements according to the examination regulations</td><td colspan="5">In order to pass each course of the module, student must obtain a minimal final grade of 11 (eleven). To compute the final grade, the fraction 0.5 or more is considered as a unit in favor the student. (Exam. Reg. 2013 Art. 21)</td></tr>
<tr><td>Recommended prerequisites</td><td colspan="5">Formal: None
Content: Communication and computing skills</td></tr>
<tr><td>Module objectives/intended learning outcomes</td><td colspan="5">After having finished the module, students are able to:
Knowledge:
- Formulate strategies considering decision analysis techniques and solution, personal barriers, ethical criteria and tools for creativity and innovation as the most important problem or opportunity facing.
- Design and implement processes aimed at developing the human capital of a business.
- Develop strategies to help you locate and develop opportunities for employability effectively and efficiently.
Skills:
- Apply techniques for problem solving and ethical decision criteria.
- Use modern theories and methodologies for managing human resources.
- Use methods to tailor your personal and professional profile to job opportunities that are presented.
Competences:
- Apply and develop skills in planning, analysis, troubleshooting, or taking advantage of opportunities to make effective and ethical decisions.
- Apply concepts and methodologies in the management of human resources.
- Harmonize their personal and professional profile to implement formal and</td></tr>
</table>

	relational strategies to help you locate and develop opportunities for employability effectively and efficiently
Content	***Decision Making**: The classic approach. The decision-making process. Identification and description of the problem in decision-making. Practical cases. Problem resolution techniques in decision-making. Team decision-making. Interpersonal barriers to decision-making. Practical cases. Social and labor ethics. Decision-Making based on an ethical perspective. Creativity and innovation in the generation of decision alternatives. Application of Creativity and Innovation in Decision-Making. Criteria to assess solution alternatives.* ***Human Resources**: Management: Fundamental skills. Management and personal supervision. Team Work. Communication in the workplace. Employee motivation. Leadership in the workplace. Workplace conflict management. Management of organizational changes. Supervision plan. Recruitment and staff selection. Individual Differences, Personality and Values in the Workplace. Training and Job Analysis. Performance and skills evaluation. Labour regulations and laws. Essay writing.* ***Induction to Labor Market**: Personal competitiveness. The résumé. Job interview, characteristics and types. Personal marketing. Employability. Employability. Types of evaluations. Staff recruitment. Understanding gestures and body language. Personal image. Professional ethics.*
Study and examination requirements and forms of examination	- *Practical: simulated job interviews.* - *Lecture: partial quizzes and final written examination.*
Media employed	*Blackboard, slides, beamer presentations, demonstration of lab examples and experiments, lab development tools and equipment.*
Reading list	- *Espíndola, José Luis (2005) Análisis de problemas y toma de decisiones. México D.F.: Addison Wesley. (153.43/E84)* - *García, Salvador (2003) La dirección por valores. Madrid: Mc Graw-Hill (179.9/G23)* - *Jennings, David (2000) Toma de decisiones: Un enfoque integrado. México D.F.: Continental 658.1G/J39)* - *Montes, Felipe (2000). Resolución de problemas y toma de decisiones. México D.F.: Trillas (153/M84)* - *Rey Sancristán, Francisco (2003). Técnicas de resolución de problemas. Madrid: s.n. (658.2/R47T)* - *Robbins, Stephen (2004) Comportamiento organizacional. México D.F.: Pearson Educación (658.3A/R71)* - *Shermerhorn, John (2006) Administración. México D.F.: Limusa (658.3A/S29)* - *Alles, Martha. (2006) Dirección estratégica de recursos humanos. Gestión por competencias. Buenos Aires: s.n. (658.3A/A43D)* - *Chiavenato, Idalberto (2006) Introducción a la teoría general de la administración. México D.F.: Mc Graw- Hill. (658.3A/CH548/2006)* - *Covey, Stephen (2000) Los 7 hábitos de la gente altamente efectiva. Barcelona: Paidos. (658.3A/C8L)* - *Goleman, Daniel (1999) Inteligencia emocional en la empresa. Buenos Aires: Industrial Gráfica. (658.1G/G71)* - *Grados, Jaime (2001) Capacitación y desarrollo de personal. México D.F.: Trillas. (658.3A/G8C)* - *Mosley, Donald (2005) Supervisión. México D.F.: Thompson (658.302/M87)* - *Robbins, Stephen (2004) Comportamiento organizacional. México D.F.: Pearson Educación. (658.3A/R71)* - *Whetten, David (2005) Desarrollo de habilidades directivas. México D.F.: Pearson Educación. (658.409/W53)* - *Bejarano, Alberto (2011). Gestión de Carrera en la Sociedad Red. Lima: ESAN (658.4093/B37)* - *Fournies, Ferdinand (1997) Técnicas de dirección de personal. Cómo instruir*

	para aumentar el rendimiento. México D. F.: Mc Graw-Hill (658.3A/F78). - *Harrison, Tony (2002) Estrategia de comunicación. Técnicas de publicidad. Lima: El comercio (658.1G/P/5)* - *Mora G., Guillermo (1995) Valores humanos y actitudes positivas. Bogotá: Mc Graw-Hill (658.3A/M79)* - *Loret de Mola, Edgardo (2009). Administración de Carrera. Lima: CENTRUM* - *Temple, Inés (2010). Usted S.A. Lima: Norma*