Academic Program: Undergraduate in Mechanical Engineering

Name of the subject: COMPUTER PROGRAMMING I	Code: **CC401**

Curricular location: first semester.

Course Description.

This course is oriented to Engineering students who are going to apply basic concepts of structured programming and object oriented programming in order to design algorithms and create computer programs, so students can solve numerical problems and character handling problems. Along the course students learn to write flow diagrams, algorithms and JAVA programming techniques to solve engineering problems.

The course leads student to Programming methods as problem solution strategies. Student learns contents of elementary and intermediate complexity.

General learning outcomes:

At the end of the course students are expected to:

Know and apply methods of object oriented programming.

Design algorithms to solve numerical problems and alphanumeric expressions.

Write computer programs to solve specific problems.

Develop their ability to work in teams with responsibility and order.

Contents:	**Hours**
1. Algorithms and problem solving. 1.1. General introduction. 1.2. Algorithms. 1.3. Flow diagram and pseudo code in problem solving. 1.4. Java and its characteristics. 1.5. Compiling a JAVA program.	**6**
2. Introduction to Object Oriented Programming. 2.1. Object oriented programming (OOP). 2.2. Java data output. 2.3. Java data input. 2.4. Variables and constants.	**12**
3. Sequences and selections. 3.1. Arithmetic expressions. 3.2 Conversions between data types. 3.3. Sequences and assignments. 3.4. Logical expressions. 3.5. Conditional (IF). 3.6. Multiple switching selections. 3.7. Multiple selection applications.	**14**
4. Loops. 4.1. Loops. 4.2. Loops with a counter (for). 4.3. Conditional loops (while y do-while). 4.4. Nested for.	**12**
5. Problems involving functions. 5.1. Functions and methods. 5.2. Static methods (static). 5.3. Parameters. 5.4. Return values (return). 5.5. Applications.	**10**
6. Problems involving vectors. 6.1. Introduction. 6.2. Vectors in JAVA. 6.3. Applications.	**10**

Learning activities: All the activities are individual or by team (general group activities or integrating subgroups). They are classified in activities inside classroom (ICA) or outside classroom (OCA) ones. All ICA's are directed by the corresponding professor or expositor (if it could be convenient). Every OCA would be finished in a completely independent form, but under the proper supervision of Faculty. For every subject the learning activities could be at least the following (or others, similar or higher in pedagogical characteristics):

1. Case Analysis to state clearly the accomplishments of the course, properly linked to the real state of contemporary engineering.
2. Cooperative sessions to analyze and solve problems. When could be convenient laboratory sessions are mandatory, of course in presence of Faculty.
3. Learning based on structures and non structured problems. The goal is that students must state, solve and discuss proposals of solutions. They must evidence research and effective communications skills, in full accordance to Institutional Learning Outcomes.
4. Plenary discussions directed by students themselves and also directed by professor. Take care that this is not the only pedagogical strategy to be adopted.
5. Project oriented learning, focused on local requirements of Engineering Science.
6. Visits to companies, in order to gather important information about state of art of the subject. When this strategy could not be pertinent, it can be substituted by conference or Case Analysis.

Assessment:
The student's learning is to be measured under the following criteria:

1. Cooperative attitude, expressed by concrete and measurable actions that will be a clear evidence of the accomplishment of learning outcomes.
2. Engagement, honesty, seriousness, responsibility, attitude of participation and creativity expressed in the furtherance of learning outcomes.
3. Ability and dexterousness expressed in problem solving.
4. Fulfillment of proposed rubrics.
5. Reasonable attendance to class (when required 100% with no failure).

Form	**Instrument**	Percentage
Problem solving	Home works, questionnaires, essays, summaries, documental and data base researches.	35%
Objective tests	At a mid term and a final written exam.	45%
Diverse products	Class project by teams, e-portfolios. Evidence generation, according the nature of subject.	20%
	TOTAL	**100%**

Bibliography

	Type	**Title**	**Author**	**Editorial**	**Year**
1	Text	Programación en Java 2.	Luis Joyanes Aguilar e Ignacio Zahonero Martínez	McGraw Hill	2002
2	Reference	Manual de Referencia Java 2.	Helbert Schildt	McGraw Hill	2001
3	Reference	Fundamentos de programación en Java2.	Helbert Schildt	McGraw Hill	2001

CETYS UNIVERSIDAD

Course Program

Course Name:	**Course ID:**
Mathematics	**MA400**

Location in the curricular map: first semester

Course characteristics:

This course is offered to students that enroll in Business Administration or Engineering in order to provide them basic mathematics that will allow them to take subsequent math courses.

The course deals with logical mathematics, math functions and algebra in a practical way. Regardless of the chosen major, engineering, as well as business administration students, must have the ability of analyzing, modeling, calculating and representing datum and figures of the studied systems.

General learning objectives:
At the end of this course the student is expected to:

Know and understand:
The following logical mathematic concepts: proposition, logic true and false tables, syllogisms, and inference law.
The following concepts of mathematic functions: function, domain and range of a function and how mathematical functions are classified.
The following algebra concepts: equation, inequality, matrix, matrix determiner, the Gauss-Jordan method and co-factors method.

Know:
How to apply logical mathematics to analyze, synthesize and evaluate the logical consistency of writings and oral expressions.
Sketch the behavior of a mathematical function and model the behavior of real phenomena through functions.
Solve linear equation systems through alegebra and matrix methods. Formulate and solve problems with linear equation systems.

Develop their capacity to work in teams in an organized and responsible way.

Thematic Content:	Hours
1. Logical mathematics. 1.1. Introduction and course set up. 1.2. Propositional logics. 1.3. Language expressions. 1.4. Logical connectives and logic true and false tables. 1.5. Formulas and logic true and false tables. 1.6. Equivalencies, tautology and fallacy. 1.7. Inferential logics. 1.8. Implication logics. 1.9. Inference law. 1.10. Consistency of premises. 1.11. Direct and indirect proof. 1.12. Syllogism analysis.	**20**
2. Mathematical functions. 2.1. Basic concepts: function, domain and range of a function. 2.2. Types of mathematic functions. 2.3. Linear functions. 2.4. Polynomial functions. 2.5. Rational functions. 2.6. Potency functions. 2.7. Functions defined in sections. 2.8. Logarithmic functions. 2.9. Exponential functions. 2.10. Trigonometric functions. 2.11. Applications of mathematical functions.	**20**
3. Linear equation systems and matrix algebra. 3.1. Equation and equation systems. 3.2 Linear equation systems with 2 variables. 3.3. Inequality systems. 3.4. Linear equation systems with more than 2 variables. 3.5. Matrix and matrix algebra. 3.6. Inverse of a matrix. 3.7. Determiners and properties of determiners. 3.8. Applications of equation systems and inequality.	**24**

Learning activities: The learning experience in this course will be individual and in groups; some directed by the instructor and others will be carried out individually by the students outside the classroom. Those carried out by the students will be held in the following way:

1. Collaborative work inside the classroom to analyze and debate over the contents directed by the instructor.
2. Case methods to apply and evaluate the scope and limitations of the course contents.
3. Cooperative work outside the classroom to analyze cases and problem solution.
4. Learning based on structured and non-structured problems so the students learn to formulate problems and apply the course contents by generating solutions, working individually as well as in teams, starting from brainstorming.
5. Contents presentation by the instructor, avoiding at all costs its becoming a custom throughout the course.
6. Learning based on application projects in teams, so the students apply their knowledge in projects of their own interest.

Assessment criteria and procedures:
Students' performance throughout the course will be based on the following criteria:

(7) The availability and cooperation manifested in concrete actions to achieve the learning objectives in each unit and the course's general objectives.
(8) The commitment, honesty, seriousness, responsibility, quality, participation and creativity manifested when executing all learning activities developed throughout the course.
(9) The ability and dexterity manifested to solve specific problems throughout the course.

Considering the criteria beformentioned, an assessment form is proposed:

Form	**Instrument**	Percentage
Problem questioning and solution	Individual and team tasks, such as questionnaires, essays, summaries, structured problems to solve and bibliographic or internet research.	35%
Problem solving	Individual objective tests: part exams and one final exam.	45%
Product request	Application, documental or field research project and a team report of the project.	20%
	TOTAL	**100%**

Bibliography

	Type	**Title**	**Author**	**Publisher**	**Year**
1	Text	Algebra and trigonometry with analytical geometry.	Earl W. Swokowski y Jeffery A. Cole	Thomson-Learning	2002
2	Reference	Introductory mathematical analysis for business, economics and life and social sciences	Ernest F. Haeussler, Richard S. Paul y Tech Laurel	Prentice-Hall	2001
3	Reference	Mathematical Analysis for Business, Economics and the Life and Social Sciences	Jagdish C. Arya y Robin W. Lardner	Pearson	1993

Syllabus

Subject: INTRODUCTION TO MECHANICAL ENGINEERING.	Code: **MC401**

Curricular location: first semester.

The course is designed to introduce first semester students to university life, finding the professional challenges and the state of art of Mechanical Engineering (especially in Aeronautical and Automotive design), and also the institutional services and equipment. A positive and proactive attitude is very necessary to understand the nature, subjects and principal issues of the program.

General Learning Outcomes.
At the end of the course students are expected to:
Know and understand:
Mission, vision and values of CETYS Universities.
Educational model.
Students' role and professor's role.
Structure of CETYS and regulations.
Origin, evolution and expectations of Engineering.
Institutional characteristics.
General profiles (admission and conclusion).}

Develop:
Simple application projects.
Capacity to work in teams.
Research skills

Contents:	Hours
1. General introduction. 1.1. Course requirements. 1.2. Learning Outcomes. 1.3. Role of student and faculty. 1.4. Structure of CETYS. 1.5. Regulations.	**8**

2. Introduction to Engineering and historical development. 2.1. Engineering sciences. 2.2. Origins and evolution. 2.3. Branches of engineering. 2.4. Present and future trends.	**10**
3. Analysis of the program. 3.1. Definition and History. 3.2. Curricular characteristics. 3.3. Expectations of graduates.	**10**
4. Selected topics in Mechanical Engineering. 4.1. Basic requirements. 4.2. Measures and instruments. 4.3. Manufacturing processes. 4.4. Basic mechanisms. 4.5. Sensors and actuators. 4.6. Material selection. 4.7. Designing styles and disciplines. 4.8. Prototypes.	**36**

Learning activities: All the activities are individual or by team (general group activities or integrating subgroups). They are classified in activities inside classroom (ICA) or outside classroom (OCA) ones. All ICA's are directed by the corresponding professor or expositor (if it could be convenient). Every OCA would be finished in a completely independent form, but under the proper supervision of Faculty. For every subject the learning activities could be at least the following (or others, similar or higher in pedagogical characteristics):

7. Case Analysis to state clearly the accomplishments of the course, properly linked to the real state of contemporary engineering.
8. Cooperative sessions to analyze and solve problems. When could be convenient laboratory sessions are mandatory, of course in presence of Faculty.
9. Learning based on structures and non structured problems. The goal is that students must state, solve and discuss proposals of solutions. They must evidence research and effective communications skills, in full accordance to Institutional Learning Outcomes.
10. Plenary discussions directed by students themselves and also directed by professor. Take care that this is not the only pedagogical strategy to be

adopted.

11. Project oriented learning, focused on local requirements of Engineering Science.
12. Visits to companies, in order to gather important information about state of art of the subject. When this strategy could not be pertinent, it can be substituted by conference or Case Analysis.

Assessment:
The student's learning is to be measured under the following criteria:

6. Cooperative attitude, expressed by concrete and measurable actions that will be a clear evidence of the accomplishment of learning outcomes.
7. Engagement, honesty, seriousness, responsibility, attitude of participation and creativity expressed in the furtherance of learning outcomes.
8. Ability and dexterousness expressed in problem solving.
9. Fulfillment of proposed rubrics.
10. Reasonable attendance to class (when required 100% with no failure).

Form	**Instrument**	Percentage
Problem solving	Home works, questionnaires, essays, summaries, documental and data base researches.	35%
Objective tests	At a mid term and a final written exam.	45%
Diverse products	Class project by teams, e-portfolios. Evidence generation, according the nature of subject.	20%
	TOTAL	**100%**

Bibliography

	Type	**Title**	**Author**	**Editorial**	**Year**
1	Text	Introduction to Mechanical Engineering	Wickert	CL-Engineering	2007
2	Reference	Guía para la supervivencia del estudiante.	W. Brown.	Editorial Limusa	2001
3	Reference	Estudiantes Triunfadores.	F. Villareal.	Editorial Trillas	2002

Course Program

Course Name: **Thinking Abilities**	**Course ID:** **CS401**

Location in the curricular map: first semester

Course characteristics:

This course's nature is theoretical and experimental and it seeks to strengthen students' cognitive abilities through specific strategies that will favor critical and creative thinking in order to solve problems, hence improving their performance in the different courses they will take throughout college, as well as in daily life. Due to its contents, this course is placed in the first semester of all majors.

General Learning Objectives:
At the end of this course the student is expected to:

Know and Understand:
The concepts of intelligence, creativity, innovation, the basic functions of the brain, divergent thought, convergent thought, emotional intelligence, as well as the formal operations of thought.

Know:
Elaborate in an individual way a self-diagnosis on each intelligence, according to Gardner.

Elaborate a personal program to develop the components of Emotional Intelligence pointed out by Goleman.

Elaborate and present an innovation project in teams.

Apply the creative process to problem solving.

Develop the capacity to work in teams in a responsible and organized way.

Thematic Content:	**Hours**
1. Thought and brain. 1.1. Introduction and course set up. 1.2. Intelligence background. 1.3. Meanings of intelligence. 1.4. Neurophisiology.	**10**
2. Types of intelligences.	

2.1. Brain hemispheres. 2.2. Convergent thought. 2.3. Divergent thought. 2.4. Emotional intelligence.	**10**
3. Emotional intelligence. 3.1. Factors according to Goleman: 3.1.1. Self conscience. 3.1.2. Selfcontrol. 3.1.3. Motivation. 3.1.4. Empathy. 3.2. Relationships management.	**14**
4. Convergent thought. 4.1. Instrumental enrichment program. 4.2. Organization (algorithmic thought). 4.3. Classifications. 4.4. Numerical progressions and syllogisms.	**14**
5. Divergent thought. 5.1. What is creativity? 5.2. Where is my creativity? 5.3. Daily life creativity. 5.4. The advantages of being creative. 5.5. Creativity myths. 5.6. Phases in the creative process. 5.7. Criteria to value creativity. 5.8. Perception. 5.9. Recovering the power of creativity.	**16**

Learning activities: The learning experience in this course will be individual and in groups; some directed by the instructor and others will be carried out individually by the students outside the classroom. Those carried out by the students will be held in the following way:

1. Collaborative work inside the classroom to analyze and debate over the contents directed by the instructor.
2. Case methods to apply and evaluate the scope and limitations of the course contents.
3. Cooperative work outside the classroom to analyze cases and problem solution.
4. Learning based on structured and non-structured problems so the

students learn to formulate problems and apply the course contents by generating solutions, working individually as well as in teams, starting from brainstorming.

5. Contents presentation by the instructor, avoiding at all costs its becoming a custom throughout the course.
6. Learning based on application projects in teams, so the students apply their knowledge in projects of their own interest.

Assessment criteria and procedures:
Students' performance throughout the course will be based on the following criteria:

(7) The availability and cooperation manifested in concrete actions to achieve the learning objectives in each unit and the course's general objectives.
(8) The commitment, honesty, seriousness, responsibility, quality, participation and creativity manifested when executing all learning activities developed throughout the course.
(9) The ability and dexterity manifested to solve specific problems throughout the course.

Considering the criteria beformentioned, an assessment form is proposed:

Form	**Instrument**	Percentage
Problem questioning and solution	Individual and team tasks, such as questionnaires, essays, summaries, structured problems to solve and bibliographic or internet research.	35%
Problem solving	Individual objective tests: part exams and one final exam.	45%
Product request	Application, documental or field research project and a team report of the project.	20%
	TOTAL	**100%**

Bibliography

	Type	Title	Author	Publisher	Year
1	Text	Intelligence Reframed: Multiple Intelligences for the 21st Century	Howard Gardner	Basic Books	2000
2	Reference	Six hats to think	Edward De Bono	Ediciones Garnica	1999
3	Reference	Emotional Intelligence	Daniel P. Goleman	Bantam Books	1997

Course Program

Course Name: Globalization and Economical Development	Course ID: EC400

Location in the curricular map: First semester

Course characteristics:
In this course students will be introduced to Globalization, in its theoretical fundamentals, as well as in its essential conditions such as: economical growth, free international trade, short term capital movement, direct foreign investment, migration phenomena, communication technology development and its cultural effect, among others.

The student will judge the advantages and disadvantages of globalization and its diverse forms. As part of the learning activities, students will carry on **application projects** through field research, application of knowledge, problem identification, methodology development, creativity and problem solving. The topics to consider are the following:

- The importance of international capital flux for development (riches and severe crisis)
- Commercial liberalization (beneficial o crisis provoker?)
- Does globalization reduce real wages or does it provoke job loss?
- How to record international activities of merchandise, services and capital?
- Changes in technology are reflected in globalization.
- The capability of national economies to generate competitive advantages.

General learning objectives:
At the end of this course the student will be able to:
Know:
What is globalization? What is the role of comercial liberalization currently? What is sustainable development? How does technology development affect communication and what is its cultural effect? What is international free trade, and direct foreign investment? When do migration phenomena occur?
Understand:
What are the advantages and disadvantages of globalization? What are the key economic variables? How can a country reach a sustainable development? What is the role of cultural differences?
Apply your knowledge on globalization and sustainable development in the analysis of cases, discussions on economical politics and course project application.
Develop the students' capacity to work in teams in a responsible and organized way.

Thematic Content:	Hours
1. Globalization. 1.1. Globalization before the 20th century. 1.2. Globalization during the 20th century. 1.3Globalization in the 20th century. 1.4. Defining globalization. 1.5. Real and virtual globalization.	**10**
2. Who regulates Globalization? 2.1. Regulating institutions in Free Trade 2.2. The International Financial Fund system (FMI). 2.3. The gold standard system. 2.4. Foreign currencies. 2.5. The payment balance. 2.6. International investment (financial rules). 2.7. International business barriers. 2.8. Paretian activities.	**11**
3. Economical growth and development. 3.1. Production possiblities. 3.2. Classical theories of growth. 3.3. Modern theories of growth. 3.4. The Harrod-Domar model. 3.5. The Solow model. 3.6. The limits of growth. 3.7. Concepts of economical convergence. 3.8. The dependence theory.	**10**
	10

4. Globalization and poverty. 4.1. Globalization and knowledge. 4.2. University and globalization. 4.3. The world of poverty. 4.4. The underdevelopment visciuos circle.	
5. Cultural globalization. 5.1. Culture and development 5.2. Tourist globalization 5.3. Globalization and its effects in migration activities. 5.4. Demography and development. 5.5. The effects on globalization on the role of women and children's rights in traditional societies. 5.5 The role of the U.S in globalization.	**10**
6. Globalization: Growth and development (cases of study). 6.1 Savings, productivity and structured growth. Case of Study: Singapore 6.2. Gradual transition from a planned economy. Case of Study: China 6.3. Import substitution. Case of Study: India 6.4 Chile's economical miracle and its politic dependance in transnational companies. Case of Study: Chile 6.5 A new American century? Iraq and the hidden war between the dollar and the euro. Case of Study. 6.4. About the origin, use and content of "sustainable". Case of Study. 6.5 Social movements in the globalization era. Case of Study. 6.6 Globalization, empire or imperialism? A contemporary debate. Case of Study. 6.7 "The Argentinean political crisis in a globalized context and one of its consequences: urban poverty" Case of Study. 6.8 "Political economy of globalization politics" Case of Study.	**13**

Learning activities: The learning experience in this course will be individual and in groups; some directed by the instructor and others will be carried out individually by the students outside the classroom. Those carried out by the students will be held in the following way:

1. Collaborative work inside the classroom to analyze and debate over the contents directed by the instructor.
2. Case methods to apply and evaluate the scope and limitations of the course contents.
3. Cooperative work outside the classroom to analyze cases and problem solution.
4. Learning based on structured and non-structured problems so the students learn to formulate problems and apply the course contents by generating solutions, working individually as well as in teams, starting from brainstorming.
5. Contents presentation by the instructor, avoiding at all costs its becoming a custom throughout the course.
6. Learning based on application projects in teams, so the students apply their knowledge in projects of their own interest.

Assessment criteria and procedures:
Students' performance throughout the course will be based on the following criteria:

(7) The availability and cooperation manifested in concrete actions to achieve the learning objectives in each unit and the course's general objectives.
(8) The commitment, honesty, seriousness, responsibility, quality, participation and creativity manifested when executing all learning activities developed throughout the course.
(9) The ability and dexterity manifested to solve specific problems throughout the course.

Considering the criteria beformentioned, an assessment form is proposed:

Form	**Instrument**	Percentage
Problem questioning and solution	Individual and team tasks, such as questionnaires, essays, summaries, structured problems to solve and bibliographic or internet research.	35%
Problem solving	Individual objective tests: part exams and one final exam.	45%
Product request	Application, documental or field research project and a team report of the project.	20%
	TOTAL	**100%**

Bibliography

	Type	**Title**	**Author**	**Publisher**	**Year**
1	Text	Globalization: A Very Short Introduction (Very Short Introductions)	Manfreb B. Steger	Oxford University Press	2003
2	Reference	Globalization & Growth: Case Studies in National Economic Strategies	Richard H. K. Vietor	South-Western College/West	2004
3	Reference	International Economics: Theory & Policy	Paul Krugman y Maurice Obstfeld	Addison-Wesley	1998

Syllabus

Subject: **Computer Assisted Drawing**	Code: **MC400**

Curricular location: second semester.

Course description:

This course is designed to offer students a knowledge basis on Engineering Drawing. Along the course students will apply the basic principles of technical drawing in the description and form of objects using the foundations of Computer Assisted Drawing.
With the knowledge acquired along the course students will make, understand and interpret the technical engineering drawings used in manufacturing mechanical parts and products designed by them.

Knowledge and skills developed by students will be very useful for a better understanding and successful development of the rest of the subjects, and in any other issue related with engineering practice.

General Learning Outcomes:

At the end of the course students are expected to:

Know:

- How to apply foundations of technical drawing in the description of objexts in orthogonal and isometric forms.
- How to apply basic rules to assign dimensions to describe any objects.
- Use principles of principal sights determination sector and auxiliary.
- Sketch engineering drawings.
- Use a convenient drawing software as AUTOCAD or higher in engineering usefulness.
- Improve self – learning skills.

Develop their capacity to work in teams with responsibility and order.

Contents:	**Hours**
1. Common drawing 1.1. General introduction. 1.2. Handmade drawing: sketching. 1.3. Principles of mechanical drawing. 1.4. Basic instruments. 1.5. Geometry.	**10**
Orthogonal projections 2.1. Systems of projections. 2.2. Sights and viewpoints. 2.3. Multiple views. 2.4. Line alphabet. 2.5. Selection of the three views representing an object. 2.6. Line precedence. 2.7. Surface projections. 2.8. Representation of holes.	**12**
3. Auxiliary views. 3.1. Sections. 3.2. Types of sectional views. 3.3. Engineering conventions. 3.4. Section and line patterns. 3.5. Primary auxiliary sight. 3.6. Secondary auxiliary sight.	**12**
4. Dimensioning. 4.1. Foundations. 4.2. Types of dimensions. 4.3. Rules for dimensioning 4.4. Engineering dimensioning.	**10**
5. Isometric projections. 5.1. Principles of isometric drawing. 5.2. Isometric sections. 5.3. Dimensioning in Isometrics.	**10**
6. Intersections and developments. 6.1. Line developments. 6.2. Radial developments. 6.3. Triangulations. 6.4. Intersections.	**10**

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1. Case Analysis to state clearly the accomplishments of the course, properly linked to the real state of contemporary engineering.
2. Cooperative sessions to analyze and solve problems. When could be convenient laboratory sessions are mandatory, of course in presence of Faculty.
3. Learning based on structures and non structured problems. The goal is that students must state, solve and discuss proposals of solutions. They must evidence research and effective communications skills, in full accordance to Institutional Learning Outcomes.
4. Plenary discussions directed by students themselves and also directed by professor. Take care that this is not the only pedagogical strategy to be adopted.
5. Project oriented learning, focused on local requirements of Engineering Science.
6. Visits to companies, in order to gather important information about state of art of the subject. When this strategy could not be pertinent, it can be substituted by conference or Case Analysis.

Assessment:
The student's learning is to be measured under the following criteria:

1. Cooperative attitude, expressed by concrete and measurable actions that will be a clear evidence of the accomplishment of learning outcomes.
2. Engagement, honesty, seriousness, responsibility, attitude of participation and creativity expressed in the furtherance of learning outcomes.
3. Ability and dexterousness expressed in problem solving.
4. Fulfillment of proposed rubrics.
5. Reasonable attendance to class (when required 100% with no failure).

Form	**Instrument**	Percentage
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Diverse products	Class project by teams, e-portfolios. Evidence generation, according the nature of subject.	20%
	TOTAL	**100%**

Bibliography

	Type	**Title**	**Author**	**Editorial**	**Año**
1	Text	Fundamentos de dibujo técnico	Warren J. Luzadder	Prentice-Hall	2000
2	Reference	Dibujo técnico	Henry Spencer, James Novak, John Dygdon, Thomas Dygdon y Cecil Spencer Henry.	Alfaomega	2004
3	Reference	Engineering Drawing and Design.	Cecil H. Jensen y J. D. Helsel.	McGraw-Hill	2002

CETYS UNIVERSIDAD

Syllabus

Subject:	Code:
DIFFERENTIAL CALCULUS	**MA401**

Curricular location: second semester.

Course characteristics.

The scope of this branch of Mathematics is dynamic: is useful to describe change and movement. That is why it regards with limit quantities. The first classes will be very useful to acquire a general scope of the subject previous to a deeper consideration of theorems and results. Some topics studied are: graphic analysis of functions in real domain, techniques for the calculation of limits, geometrical and physical applications, use of derivatives to solve engineering problems and so forth. This course is strongly related to Integral Calculus, Differential Equations, Multivariate Calculus, Physics (I, II, III), Probability and Statistics.

General Learning Outcomes:
At the end of the course students are expected to:
Know the basis of Calculus in one real variable, continuity of functions and derivatives.

Understand: all the concepts above as fundamental engineering tools.

Apply: all the concepts above to identify, state, solve and discuss problems in maxima and minima under one real variable, and time rate changes as well.

Develop: their ability to work in teams with responsibility and order.

Contents:	Hours
1. Limits and derivatives. 1.1. General introduction. 1.2. Mathematical modeling using functions. 1.3. Limits. 1.4. Theorems in limits. 1.5. One sided limits. 1.6. Limits to infinity.	**20**

1.7. Continuity. 1.8. Tangent lines, instant velocities and time rates. 1.9. Derivatives.	
2. Differentiating rules. 2.1. Polynomial and exponential functions. 2.2. Rules for products and quotients. 2.3. Derivatives of trigonometric functions. 2.4. Chain rule. 2.5. Implicit differentiation. 2.6. Higher order derivatives. 2.7. Exponential functions. 2.8. Derivatives of logarithms.	**20**
3. Applications. 3.1. Time rates. 3.2. Maxima and minima. 3.3. Rolle's theorem and mean value theorem. 3.4. Graphic analysis. 3.5. Sketching curves. 3.6. Undetermined forms and L'Hôpital's rule. 3.7. Optimization.	**24**

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4. Plenary discussions directed by students themselves and also directed by professor. Take care that this is not the only pedagogical strategy to be adopted.
5. Project oriented learning, focused on local requirements of Engineering

Science.

6. Visits to companies, in order to gather important information about state of art of the subject. When this strategy could not be pertinent, it can be substituted by conference or Case Analysis.

Assessment:
The student's learning is to be measured under the following criteria:

1. Cooperative attitude, expressed by concrete and measurable actions that will be a clear evidence of the accomplishment of learning outcomes.
2. Engagement, honesty, seriousness, responsibility, attitude of participation and creativity expressed in the furtherance of learning outcomes.
3. Ability and dexterousness expressed in problem solving.
4. Fulfillment of proposed rubrics.
5. Reasonable attendance to class (when required 100% with no failure).

Form	**Instrument**	Percentage
Problem solving	Home works, questionnaires, essays, summaries, documental and data base researches.	35%
Objective tests	At a mid term and a final written exam.	45%
Diverse products	Class project by teams, e-portfolios. Evidence generation, according the nature of subject.	20%
	TOTAL	**100%**

Bibliography

	Type	**Title**	**Author**	**Editorial**	**Year**
1	Text	Cálculo de una variable: Trascendentes Tempranas	James Stewart.	Thomson.	2001
2	Reference	Calculus with analytic geometry	C. Henry Edwards y David E. Penney	Prentice-Hall	2002
3	Reference	Calculus	Earl W. Swokowski	PWS Publishing	2000

CETYS UNIVERSIDAD

Syllabus

Subject: COMPUTER PROGRAMMING II	Code: **CE402**

Curricular location: second semester.

Course description.

This course is oriented to Engineering students, who will strength programming skills under the object oriented protocol in order to solve every day numerical and logical problems in engineering practice. In the first part of the course students are expected to create classes, and apply the graphic interface to solve problems. In the second part students will create objects and export them to at least to different applications. Programming language is JAVA at advanced level or any similar or higher in characteristics and quality.

General learning outcomes:

At the end of the course students are expected to:

Know and understand concepts of object oriented programming: classes, objects, recycling, graphic interface, predefined class, proper class, encapsulation, heritage and polymorphism.

Develop: Algorithms and programs using JAVA, similar or higher.

Contents:	Hours
1. Introduction. 1.1. Course characteristics. 1.2. Classes and Objects using JAVA. 1.3. Recycling. 1.4. Evolving data types. 1.5. The class String.	**8**
2. Prescribed classes to handle data. 2.1. Arrays. 2.2. Applications.	**8**
	8

3. Graphic User Interface. 3.1. Concepts and definitions. 3.2 Abstract Windows Toolkit. 3.3. Applications. **4. Prescribed classes.** 4.1. Files. 4.2. Classes involving files. 4.3. Applications. **5. User designed classes**. 5.1. Encapsulation, heritage and polymorphism. 5.2. User designed classes. 5.3. Applications. **6. Data structures.** 6.1. Definitions. 6.2. Design of Data Structures. 6.3. Applications.	**8** **18** **14**

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1. Case Analysis to state clearly the accomplishments of the course, properly linked to the real state of contemporary engineering.
2. Cooperative sessions to analyze and solve problems. When could be convenient laboratory sessions are mandatory, of course in presence of Faculty.
3. Learning based on structures and non structured problems. The goal is that students must state, solve and discuss proposals of solutions. They must evidence research and effective communications skills, in full accordance to Institutional Learning Outcomes.
4. Plenary discussions directed by students themselves and also directed by professor. Take care that this is not the only pedagogical strategy to be adopted.
5. Project oriented learning, focused on local requirements of Engineering Science.

6. Visits to companies, in order to gather important information about state of art of the subject. When this strategy could not be pertinent, it can be substituted by conference or Case Analysis.

Assessment:
The student's learning is to be measured under the following criteria:

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2. Engagement, honesty, seriousness, responsibility, attitude of participation and creativity expressed in the furtherance of learning outcomes.
3. Ability and dexterousness expressed in problem solving.
4. Fulfillment of proposed rubrics.
5. Reasonable attendance to class (when required 100% with no failure).

Form	**Instrument**	Percentage
Problem solving	Home works, questionnaires, essays, summaries, documental and data base researches.	35%
Objective tests	At a mid term and a final written exam.	45%
Diverse products	Class project by teams, e-portfolios. Evidence generation, according the nature of subject.	20%
	TOTAL	**100%**

Bibliography

	Type	**Title**	**Author**	**Editorial**	**Year**
1	Text	JAVA 2: Manual de programación.	Luis Joyanes Aguilar y Matilde Fernández Azuela	McGraw-Hill	2001
2	Reference	JAVA 2: Manual de referencia.	Herbert Schildt	McGraw-Hill	2001
3	Reference	JAVA 2: Curso de programación.	Fco. Javier Ceballos	AlfaOmega	2000

Syllabus

Subject: PHYSICS I	Code: **FI400**

Curricular location: second semester.

Characteristics of the course.

This is a practical and theoretical course which will lead students to the complete understanding of the principles of Statics. Along the course students will know and understand how to calculate the conditions of Mechanical Equilibrium for particles and Rigid Bodies, also centers of gravity and moments of inertia will be calculated for simple geometries. This course has the complete foundations for the next: Dynamics. Students are supposed to understand Algebra and Differential Calculus which is given simultaneously.

General Learning Outcomes.
At the end of the course students are expected to:

Know and understand systems of units and measuring, vectors and scalars and equilibrium conditions for rigid body elements.

Know how to convert from one system of units to another.

Calculate the conditions of equilibrium for particles, rigid bodies and structures.

Contents:	**Horas**
1. Algorithms and problem solving. 1.1. General introduction. 1.2. Systems of units. 1.3. Equivalences and conversions.	**6**
2. Vectors 2.1. Scalars and vectors. 2.2. Vector addition. 2.3. Cartesian components. 2.4. Forces on a particle.	**12**

2.5. Resultant force for concurrent components. 2.6. Equilibrium of the particle	
3. Equivalent systems of force. 3.1. Moments. 3.2. Couples. 3.3. Equivalent couples. 3.4. Systems of equivalent forces.	**12**
4. Mechanical equilibrium. 4.1. Free body diagram. 4.2. Equilibrium conditions. 4.3. Equilibrium of rigid bodies in two or three dimensions.	**12**
5. Trusses. 5.1. Introduction. 5.2. Types of trusses. 5.3. Methods of analysis.	**12**
6. Centroids and moment of inertia. 6.1. Plane Centroids. 6.2. Moment of inertia. 6.3. Steinner's theorem. 6.4. Radius of gyration. 6.5. Section module.	**10**

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3. Learning based on structures and non structured problems. The goal is that students must state, solve and discuss proposals of solutions. They must evidence research and effective communications skills, in full accordance to Institutional Learning Outcomes.
4. Plenary discussions directed by students themselves and also directed by professor. Take care that this is not the only pedagogical strategy to be

adopted.

5. Project oriented learning, focused on local requirements of Engineering Science.
6. Visits to companies, in order to gather important information about state of art of the subject. When this strategy could not be pertinent, it can be substituted by conference or Case Analysis.

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3. Ability and dexterousness expressed in problem solving.
4. Fulfillment of proposed rubrics.
5. Reasonable attendance to class (when required 100% with no failure).

Form	**Instrument**	Percentage
Problem solving	Home works, questionnaires, essays, summaries, documental and data base researches.	35%
Objective tests	At a mid term and a final written exam.	45%
Diverse products	Class project by teams, e-portfolios. Evidence generation, according the nature of subject.	20%
	TOTAL	**100%**

Bibliography

	Type	**Title**	**Author**	**Editorial**	**Year**
1	Text	Engineering Mechanics: Statics	Anthony Bedford y Wallace T. Fowler	Prentice-Hall	2001
2	Reference	Vector Mechanics for Engineers, Statics and Dynamics	Ferdinand P. Beer y E. Russell Jr. Johnston	McGraw-Hill	2003
3	Reference	Engineering Mechanics - Statics	Russell C. Hibbeler	Prentice-Hall	2003

Syllabus

Subject: ENGINEERING MATERIALS	Code: **MF400**

Curricular location: second semester.

Characteristics of the course.

The course is devoted to properties of materials, regarding different levels of internal structure. It includes scientific foundations of any observable property of the engineering materials, which make possible identify them. Includes: crystals, atomic structure, variation of these properties and particular characteristics for the most important materials. Students are required to know about elementary properties of materials. The course is a consistent basis for manufacturing and machining courses, Metallurgy and design.

General learning outcomes:
At the end of the course students are expected to:

Know and understand: foundations of engineering materials, classification of them, microscopic structures, scientific bases to relate levels of material structure and properties and usual terminology.

Make distinction in properties and characteristics of materials.

Interpret diagrams of alloys to the proper engineering selection.

Contents:	**Hours**
1. General Introduction.	**10**
1.1. Course description.	
1.2. Materials science and engineering.	
1.3. Types of materials.	
1.4. Materials selection.	
1.5. Relation between and selection and properties.	
2. Atomic structure and Atomic bonding.	
2.1. Atom.	
2.2. Electronic structure.	**8**

2.3. Periodic table. 2.4. Primary force bonding. 2.5. Secondary force bonding. 2.6. Atomic coordination.	
3. Crystal structure. 3.1. General introduction. 3.2. Unit cells. 3.3. Positions, directions and planes in a unit cell. 3.4. Structure of engineering materials.	**12**
4. Crystal failures. 4.1. Solid state. 4.2. Imperfections in crystals. 4.3. Grains.	**8**
5. Phase diagram. 5.1. Solidification of pure substances. 5.2. Phase and component. 5.3. Phase diagram. 5.4. Chemical composition or phases. 5.5. Growing of crystals. 5.6. Fe-C diagram for steel.	**12**
6. Engineering materials**.** 6.1. Metals and alloys. 6.2. Testing metals. 6.3. Ceramics and glasses. 6.4. Types of glasses. 6.5. Mechanical and optical properties. 6.6. Polymers. 6.7. Polymerization. 6.8. Properties of polymers (optical and mechanical). 6.9. Compounds. 6.10. Fiber reinforced compounds. 6.11. Aggregates.	**14**

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linked to the real state of contemporary engineering.

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5. Project oriented learning, focused on local requirements of Engineering Science.
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Assessment:
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2. Engagement, honesty, seriousness, responsibility, attitude of participation and creativity expressed in the furtherance of learning outcomes.
3. Ability and dexterousness expressed in problem solving.
4. Fulfillment of proposed rubrics.
5. Reasonable attendance to class (when required 100% with no failure).

Form	**Instrument**	Percentage
Problem solving	Home works, questionnaires, essays, summaries, documental and data base researches.	35%
Objective tests	At a mid term and a final written exam.	45%
Diverse products	Class project by teams, e-portfolios. Evidence generation, according the nature of subject.	20%
	TOTAL	**100%**

Bibliography

	Type	Title	Author	Editorial	Year
1	Text	Essentials of materials for science and engineering	Donald R. Askeland	Thomson-Engineering	2004
2	Reference	Foundations of materials science and engineering	William F. Smith y William Smith	McGraw-Hill	2003
3	Reference	Materials science for engineers	James F. Shakelford	Prentice Hall	1999

Course Program

Course Name:	**Course ID:**
Culture I	**CS403**

Location in the curricular map: Second semester.

Course characteristics:

This course is applied to all 2004 college programs, regardless of their major, students will be exposed to a vision of art history, history of thought and history of culture, in a way that students will develop sensitivity towards artistic expressions.

This course is not intended for students to acquire or develop artistic abilities, they will know and understand how art works, their impact on culture and society in general.

However, if this comprehension and understanding of art is achieved, a sense of appreciation will be born towards thought and culture in their diverse expressions, with which a professional acquires a complete structure of thought.

General learning objectives:
At the end of this course the student is expected to:

Know:

The state of the art of culture (at a conceptual level)
The importance of culture in society.
The diverse stages in the development of art and its impact on society
The diverse phases of the development of thought and ideas.

Identify:

Culture as an inherent part of all social processes.
Art as an everyday demonstration of human life.
Art as a cultural demonstration and act of communication.
The context of the generation and transmission of knowledge.
Criteria to appreciate art that goes beyond beauty, expression and balance.

Develop:

Their capacity of analysis of the diverse cultural and artistic demonstrations of today's society.
Conceptual framework of the development of knowledge
Sensitivity and appreciation for artistic expressions that motivate to enjoy the forms of art that interest them.
Conceptual framework of art and expressions.
Ability to communicate in an oral and written form.

Thematic Content:	Hours
1**. Theory of culture** 1.1. Introduction and set up 1.2. Towards a concept of culture 1.3. Culture and communication 1.4. Virtual and dynamic culture 1.5. Cultural rights in globalization	**12**
2. History of the thought of ideas 2.1. The awakening of men 2.2. From antiquity to the Middle Ages 2.3. From 1942 to the 20th century 2.4. Postmodernism and the information era	**10**
3. History of Art 3.1. The classical and traditional 3.2 Antique art 3.3. The renaissance 3.4 Modern and contemporary art.	**10**

Learning activities: The learning experience in this course will be individual and in groups; some directed by the instructor and others will be carried out individually by the students outside the classroom. Those carried out by the students will be held in the following way:

1. Collaborative work inside the classroom to analyze and debate over the contents directed by the instructor.
2. Case methods to apply and evaluate the scope and limitations of the course contents.
3. Cooperative work outside the classroom to analyze cases and problem solution.
4. Learning based on structured and non-structured problems so the students learn to formulate problems and apply the course contents by generating solutions, working individually as well as in teams, starting from brainstorming.
5. Contents presentation by the instructor, avoiding at all costs its becoming a custom throughout the course.
6. Learning based on application projects in teams, so the students apply their knowledge in projects of their own interest.

Assessment criteria and procedures:
Students' performance throughout the course will be based on the following criteria:

(7) The availability and cooperation manifested in concrete actions to achieve the learning objectives in each unit and the course's general objectives.
(8) The commitment, honesty, seriousness, responsibility, quality, participation and creativity manifested when executing all learning activities developed throughout the course.
(9) The ability and dexterity manifested to solve specific problems throughout the course.

Considering the criteria beformentioned, an assessment form is proposed:

Form	**Instrument**	Percentage
Problem questioning and solution	Individual and team tasks, such as questionnaires, essays, summaries, structured problems to solve and bibliographic or internet research.	35%
Problem solving	Individual objective tests: part exams and one final exam.	45%
Product request	Application, documental or field research project and a team report of the project.	20%
	TOTAL	**100%**

Bibliography

	Type	**Title**	**Author**	**Publisher**	**Year**
1	Text	History of art: Slipcased	Anthony H. W. Y Janson Janson	Harry N Abrams	2001
2	Reference	Hybrid cultures	Néstor García Canclini	Paidos	2000
3	Reference	Life and death of ideas: Short stories of western thought.	José María Valverde	Ariel	2003

Syllabus

Subject: INTEGRAL CALCULUS	**Code:** **MA402**

Curricular location: third semester.

Characteristics of the course.

This course is natural continuation of Differential Calculus. It represents one of the basic foundations to develop higher courses in engineering. Students will identify the principal techniques of Integration: Definite and Indefinite, applied of course to determination of Areas, Volumes and other Engineering applications. Students are expected to know and understand algebraic and transcendental functions (exponential, logarithmic and trigonometric).

General Learning Outcomes.

At the end of the course students are expected to:

Know and understand what is an integral, definite or indefinite and the principal technique of integration useful in Engineering.

Evaluate volumes and surfaces using infinite sums and their limits, specially applying conic sections.
Make a catalog of integrals and basic formulae, validating results with real prototypes.

Contents:	**Hours**
1. Integrals: general introduction. 1.1 Areas and distances. 1.2 Summation notation. 1.3 Definite integral as limit of a sum. 1.4 Fundamental properties of definite integrals: linearity. 1.5 Fundamental theorem of Calculus.	**20**
2. Definite integral. 2.1 Fundamental formulae of integration. 2.2 Change of variables. 2.3 Integration by parts.	**20**

2.4 Integration by trigonometric substitution. 3. Applications of Integrals. 3.1 Surfaces. 3.2 Surfaces under more than one curve. 3.3 Volumes: sections and annulus. 3.4 Application project.	**24**

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1. Case Analysis to state clearly the accomplishments of the course, properly linked to the real state of contemporary engineering.
2. Cooperative sessions to analyze and solve problems. When could be convenient laboratory sessions are mandatory, of course in presence of Faculty.
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6. Visits to companies, in order to gather important information about state of art of the subject. When this strategy could not be pertinent, it can be substituted by conference or Case Analysis.

Assessment:
The student's learning is to be measured under the following criteria:

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2. Engagement, honesty, seriousness, responsibility, attitude of participation and creativity expressed in the furtherance of learning outcomes.
3. Ability and dexterousness expressed in problem solving.
4. Fulfillment of proposed rubrics.
5. Reasonable attendance to class (when required 100% with no failure).

Form	**Instrument**	Percentage
Problem solving	Home works, questionnaires, essays, summaries, documental and data base researches.	35%
Objective tests	At a mid term and a final written exam.	45%
Diverse products	Class project by teams, e-portfolios. Evidence generation, according the nature of subject.	20%
	TOTAL	**100%**

Bibliography

	Type	**Title**	**Author**	**Editorial**	**Year**
1	Text	**"Cálculo de una Variable: Trascendentes tempranas".**	James Stewart.	Editorial: Thomson Learning.	2001
2	Reference	"Cálculo". Volumen I	Robert T. Smith y Roland B. Minton	McGraw-Hill, Second edition.	2003
3	Reference	Cálculo	Edwin J. Purcell, Dale Varberg y Steven E. Rigdon	Prentice-Hall, Eighth edition.	2001

Syllabus

Subject: PHYSICS II	**Code:** **FI401**

Curricular location: third semester

Course characteristics:

The course introduces students to Dynamics, Second Newton's Law, Work and Energy, Impulse and Momentum. Also Conservation Laws are studied in detail for conservative systems. In addition many laboratory practices are developed to have clear idea of the statistical handling of laboratory data. Students are supposed to know Algebra, Differential Calculus and the basis of Integral calculus.

General Learning Outcomes.
At the end of the course students are expected to:
Know the principles that make possible motion, under kinematical and kinetic laws of nature.
Apply knowledge to practical engineering application.
Give a correct measure of acceleration of gravity.
Use stroboscope to state equation of motion of objects.
Construct a prototype that illustrates clearly at least one principle of conservation.

Contents:	**Hours**
1. Kinematics: rectilinear motion.	**14**
1.1. General introduction.	
1.2. Course purposes and scope.	
1.3. Position, velocity, acceleration.	
1.4. Acceleration of gravity.	
1.5. Graphic analysis.	
1.6. Instantaneous and mean values.	
2. Dynamics in Cartesian coordinates.	
2.1. Free body and mass acceleration diagram.	**10**
2.2. Forces depending on time.	
2.3. Forces depending on position.	

2.4. Forces depending on velocity. 3. Particle Dynamics in curvilinear coordinates. 3.1. Tangent and normal coordinates. 3.2. Polar and cylindrical coordinates. 3.3. Dynamics and force determination.	**13**
4. Conservation. 4.1 Work produced by force. 4.2 Conservation of energy. 4.3 Conservative forces. 4.4 Mechanical power. 4.5 Impulse and momentum.	**13**
5. Systems of particles and Rigid Bodies. 5.1. Relative quantities. 5.2. Collisions. 5.3. Conserved quantities. 5.4. Type of motion of rigid bodies. 5.5. Mass moment of inertia. 5.6. Plane motion of rigid bodies..	**14**

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Assessment:
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Form	**Instrument**	Percentage
Problem solving	Home works, questionnaires, essays, summaries, documental and data base researches.	35%
Objective tests	At a mid term and a final written exam.	45%
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Bibliography

	Type	**Title**	**Author**	**Editorial**	**Year**
1	Text	**"Mecánica para Ingenieros. Dinámica".**	Anthony Bedford y Wallace Fowler.	Pearson Educación.	2000.
2	Reference	Vector Mechanics for Engineers, Dynamics	Ferdinand. P. Beer, E. Russell Johnston, William E. Clausen y George Staab	Editorial McGraw-Hill Science/Engineering/Math, 7th.	2003.
3	Reference	Engineering Mechanics: Dynamics	Russell C. Hibbler.	Editorial Prentice Hall, 7th.	1995.

Syllabus

Subject:	**Code:**
NUMERICAL METHODS	**MA403**

Curricular location: third semester.

Characteristics of the course.

In this course students will apply programming skills to develop algorithms and heuristic models to solve numerical problems of Engineering practice. Some techniques studied are: solving equations (algebraic and transcendental), interpolation, least squares, numerical integration, and applied projects to engineering problems. A programming language is required (Java, C#, similar or higher in mathematical capability).

General Learning Outcomes:

At the end of the course students are expected to:

Know and understand the methods of numerical analysis useful in engineering.

Write JAVA, C# (similar or higher) computer programs to solve transcendental equations by at least three different methods.

Determine definite integrals (convergent).

Determine interpolation, extrapolation and function description of curves with prescribed points.

Contents:	**Horas**
1. Numerical solution of equations. 1.1. General Introduction. 1.2 Algorithms, iterative processes, rounding and error distribution. 1.3 Iterative methods for equations in one unknown. 1.4 Newton – Raphson method (NRM) and improved NRM. 1.5 Regula Falsi. 1.6 Linear interpolation. 1.7 Lagrange polynomials.	**17**

1.8 Divided differences (Newton Method). 2. Numerical Integration and differentiation. 2.1 Trapezoidal approximation. 2.4 Simpson's method. 2.5 Approximate differentiation. 2.4 Application: functions expressed by infinite series. 3. Numerical Methods and Linear Algebra. 3.1 Method of Cholesky. 3.2 Pivot strategies. 3.3 Method of Gauss. 3.4 Method of Gauss and Seidel. 3.5 Factoring special matrices. 4. Least squares. 4.1 Estimating minimum error. 4.2 Straight line fitting. 4.3 Changes of variables to convert general to linear models. 4.4 Application project.	**15** **17** **15**

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6. Visits to companies, in order to gather important information about state of

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4. Fulfillment of proposed rubrics.
5. Reasonable attendance to class (when required 100% with no failure).

Form	**Instrument**	Percentage
Problem solving	Home works, questionnaires, essays, summaries, documental and data base researches.	35%
Objective tests	At a mid term and a final written exam.	45%
Diverse products	Class project by teams, e-portfolios. Evidence generation, according the nature of subject.	20%
	TOTAL	**100%**

Bibliography

	Type	**Title**	**Author**	**Editorial**	**Year**
1	Text	**"Matemáticas Avanzadas para Ingeniería".**	Erwn Kreyszig.	Limusa Wiley.	2000.
2	Referencia	An Introduction to Numerical Methods and Analysis	James F. Epperson.	Editorial Wiley.	2001
3	Referencia	Numerical Methods for Engineers: With Software and Programming Applications.	Steven C. Chapra y Raymond Canale.	Editorial McGraw-Hill.	2001

Syllabus

Subject:	**Code:**
MATERIALS MANUFACTURING	**MF401**

Curricular location: third semester.

Course description.

In this course students will understand the steps for life cycle of manufactured products from the mechanical viewpoint. Industrial materials are studied as raw materials and also as final products. Processing methods are studied. Some experience in engineering materials is strongly recommended. At the end of the course students will state the conditions that permit machining, manufacturing and design in order to produce finished products.

General learning outcomes:

At the end of the course students are expected to know and understand:

- Steps for product manufacturing.
- Manufacturing processes.
- Classification of steel.
- Foundry.
- Properties and uses of metals and non ferrous alloys.
- Molding.
- Metal transformation processes.
- Cleaning and finishing of metallic parts.
- Assembling.
- Improve styles of work with steels.

Make a glossary of manufacturing processes and a comparison of better engineering materials.
Construct any final product applying sand blast techniques.
Solve problems involving calculus of processing time of materials.
Test mechanical properties of steel pieces.

Contents:	**Hours**
1. Manufacturing and production.	
1.1. General introduction.	**16**
1.2. History of manufacturing.	
1.3. Basic manufacturing steps.	
1.4. Classification of manufacturing processes.	
1.5. Steels with non metals mixtures.	
1.6. Production and classification of steels.	
1.7. Continuous processes and foundry.	
1.8. Classification of production processes of steel.	
1.9. Ferrous and non ferrous alloys.	
2. Foundry, molding and accessory processes.	
2.1. Foundry using sand.	
2.2. Foundry in permanent molding.	
2.3. Special processing.	
2.4. Molding and processing of plastics.	**18**
3. Metal conformation.	
3.1. Machining.	
3.2. Deformation.	
3.3. Dust metallurgy.	**12**
4. Surface treatment and assembling.	
4.1. Cleaning and finishing.	
4.2. Assembling.	
	8
5. Improving processes.	
5.1. Fe – C diagram for steels.	
5.2. Frequent thermal treatment.	**8**

Learning activities: All the activities are individual or by team (general group activities or integrating subgroups). They are classified in activities inside classroom (ICA) or outside classroom (OCA) ones. All ICA's are directed by the corresponding professor or expositor (if it could be convenient). Every OCA would be finished in a completely independent form, but under the proper supervision of Faculty. For every subject the learning activities could be at least the following (or others, similar or higher in pedagogical characteristics):

1. Case Analysis to state clearly the accomplishments of the course, properly linked to the real state of contemporary engineering.
2. Cooperative sessions to analyze and solve problems. When could be convenient laboratory sessions are mandatory, of course in presence of

Faculty.

3. Learning based on structures and non structured problems. The goal is that students must state, solve and discuss proposals of solutions. They must evidence research and effective communications skills, in full accordance to Institutional Learning Outcomes.
4. Plenary discussions directed by students themselves and also directed by professor. Take care that this is not the only pedagogical strategy to be adopted.
5. Project oriented learning, focused on local requirements of Engineering Science.
6. Visits to companies, in order to gather important information about state of art of the subject. When this strategy could not be pertinent, it can be substituted by conference or Case Analysis.

Assessment:
The student's learning is to be measured under the following criteria:

1. Cooperative attitude, expressed by concrete and measurable actions that will be a clear evidence of the accomplishment of learning outcomes.
2. Engagement, honesty, seriousness, responsibility, attitude of participation and creativity expressed in the furtherance of learning outcomes.
3. Ability and dexterousness expressed in problem solving.
4. Fulfillment of proposed rubrics.
5. Reasonable attendance to class (when required 100% with no failure).

Form	**Instrument**	Percentage
Problem solving	Home works, questionnaires, essays, summaries, documental and data base researches.	35%
Objective tests	At a mid term and a final written exam.	45%
Diverse products	Class project by teams, e-portfolios. Evidence generation, according the nature of subject.	20%
	TOTAL	**100%**

Bibliography

	Type	Title	Author	Editorial	Year
1	Text	Fundamentals of Modern Manufacturing : Materials, Processes, and Systems	Mikell Groover	Wiley, 2nd	2003.
2	Reference	Introduction to Manufacturing Processes	John A. Schey	McGraw-Hill, 3rd	2000.
3	Reference	Modern Materials and Manufacturing Processes	Gregg Bruce R.; William K. Dalton; John E. Neely y Richard R. Kibbe	Prentice-Hall, 3rd	2003.

Course Program

Course Name:	**Course ID:**
Advanced Communication in Spanish	**CS400**

Location in the curricular map: third semester.

Course characteristics:

As a workshop, this course deals with the practice of the process that implies planning different writings, discourses and oral presentations before different listeners in order to inform, motivate and convince.

General learning objectives:

At the end of this course the student is expected to:

Know and apply their abilities regarding planning, the correct and ideal structure and writing of documents to communicate in public for specific purposes.

Write information of different, trustworthy sources that support an oral presentation before a specific public.

Oral and body language for informative, motivational and persuasive discourses.

Design oral presentations that reflect the contents of the course.

Build an individual public presentation using verbal and visual support.

Develop an analysis scheme from cases, exercises, videos and other dynamic techniques that will allow students to improve their communication abilities.

Thematic Content:	**Hours**
1. Introduction, set up and general concepts 1.1. The human communication process 1.2. Nature and purpose of the course 1.3. The importance of the course for college students 1.4. Application video	**10**
2. Discourse creative planning 2.1. Purpose specification. 2.2. Theme selection 2.3. Discourse planning and writing 2.4. The role of the introduction and conclusion in a discourse 2.5. Application video	**14**
3. Discourse elaboration according to different purposes 3.1. Information discourse 3.2. Motivation discourse 3.3. Convincing discourse 3.4. Application video	**14**
4. Communicator and discourse support 4.1. Verbal support 4.2. Visual support 4.3. Visual communication 4.4. Application video	**14**
5. Characteristics of a good communicator 5.1. Credibility 5.2. Honesty 5.3. Know how to listen 5.4. Improvisation 5.5. Persuation ethics 5.6. Cases of application	**12**

Learning activities: The learning experience in this course will be individual and in groups; some directed by the instructor and others will be carried out individually by the students outside the classroom. Those carried out by the students will be held in the following way:

1. Collaborative work inside the classroom to analyze and debate over the contents directed by the instructor.
2. Case methods to apply and evaluate the scope and limitations of the course contents.
3. Cooperative work outside the classroom to analyze cases and problem solution.
4. Learning based on structured and non-structured problems so the students learn to formulate problems and apply the course contents by generating solutions, working individually as well as in teams, starting from brainstorming.
5. Contents presentation by the instructor, avoiding at all costs its becoming a custom throughout the course.
6. Learning based on application projects in teams, so the students apply their knowledge in projects of their own interest.

Assessment criteria and procedures:
Students' performance throughout the course will be based on the following criteria:
(1) The availability and cooperation manifested in concrete actions to achieve the learning objectives in each unit and the course's general objectives.
(2) The commitment, honesty, seriousness, responsibility, quality, participation and creativity manifested when executing all learning activities developed throughout the course.
(3) The ability and dexterity manifested to solve specific problems throughout the course.

Considering the criteria beformentioned, an assessment form is proposed:

Form	**Instrument**	Percentage
Problem questioning and solution	Individual and team tasks, such as questionnaires, essays, summaries, structured problems to solve and bibliographic or internet research.	35%
Problem solving	Individual objective tests: part exams and one final exam.	45%
Product request	Application, documental or field research project and a team report of the project.	20%
	TOTAL	**100%**

Bibliography

	Type	**Title**	**Author**	**Publisher**	**Year**
1	Text	Communicate!	Rudolph F. Verderber	Thomson	1999
2	Reference	Oral communication, the art and science of speaking in public	Hielen McEntee de Madero	Alambra Mexicana	1992
3	Reference	Non-verbal communication	Mark Knapp L.	Paidós	1997

Course Program

Course Name: Culture II	**Course ID:** CS404

Location in the curricular map: Third semester

Course Characteristics:

This course is applied to all college programs, regardless of their major, students will be exposed to a vision of the arts. This course is not intended for students to acquire or develop artistic abilities, but to know and understand how art works. However, if this comprehension and understanding of art is achieved, a sense of appreciation will be born towards art in its diverse expressions, with which a professional acquires a complete structure of thought.

General learning Objectives:
At the end of this course the student is expected to:
Know:
✱ The four great sides of Art.
✱ The social context and the development of artistic disciplines. Identify:
- ✱ The different art disciplines
- ✱ The diverse genres in art
- ✱ The principal aesthetic proposals
- ✱ The formal, cultural and semantic level of artwork and/or the artistic demonstration.

Develop:
✱ An appreciation for artistic expressions.
✱ Opinions and points of view on artistic expressions that go beyond taste or aesthetic appreciation.
✱ Body Language
✱ Oral and written communication.

Thematic Content:	**Hours:**
1. Scenic arts. 1.1. Introduction and course set up. 1.2. Theater. 1.3. Dancing. 1.4. Opera.	8
2. Visual Arts. 2.1. Photography. 2.2. Cinema. 2.3. Painting. 2.4. Sculpting.	8
3. Literature. 3.1. Literature, creation and critical literature. 3.2. Literature genre. 3.3. Select topics of Literature.	8
4. Music. 4.1. Music and its language. 4.2. Elements in a musical: melody, harmony, rhythm and lyrical structure. 4.3. Musical genres, their expressions and evolutions.	8

Learning activities: The learning experience in this course will be individual and in groups; some directed by the instructor and others will be carried out individually by the students outside the classroom. Those carried out by the students will be held in the following way:

1. Collaborative work inside the classroom to analyze and debate over the contents directed by the instructor.
2. Case methods to apply and evaluate the scope and limitations of the course contents.
3. Cooperative work outside the classroom to analyze cases and problem solution.
4. Learning based on structured and non-structured problems so the students learn to formulate problems and apply the course contents by generating solutions, working individually as well as in teams, starting from brainstorming.
5. Contents presentation by the instructor, avoiding at all costs its becoming a custom throughout the course.
6. Learning based on application projects in teams, so the students apply their knowledge in projects of their own interest.

Assessment criteria and procedures:
Students' performance throughout the course will be based on the following criteria:
(7) The availability and cooperation manifested in concrete actions to achieve the learning objectives in each unit and the course's general objectives.
(8) The commitment, honesty, seriousness, responsibility, quality, participation and creativity manifested when executing all learning activities developed throughout the course.
(9) The ability and dexterity manifested to solve specific problems throughout the course.

Considering the criteria before mentioned, an assessment form is proposed:

Form	**Instrument**	Percentage
Problem questioning and solution	Individual and team tasks, such as questionnaires, essays, summaries, structured problems to solve and bibliographic or internet research.	35%
Problem solving	Individual objective tests: part exams and one final exam.	45%
Product request	Application, documental or field research project and a team report of the project.	20%
	TOTAL	**100%**

Bibliography

	Type	**Title**	**Author**	**Publisher**	**Year**
1	Text	History of art: Slipcased.	Anthony H. W. y Janson Janson	Harry N Abrams	2001
2	Reference	Understanding music.	Jeremy Judkin	Prentice-Hall	2001
3	Reference	Bedford Introduction to Literature: Reading, Thinking, Writing.	Michael Meyer	Bedford/St. Martin's	2001

Syllabus

Subject: PROBABILITY	Code: MA404

Curricular location: fourth semester.

Course description.

In this course students are required to understand the foundations of Probability theory. They will know about random variables, sampling, conditional probability, Bayes' theorem, and functions of random variables. Students are required to complete two Calculus courses and have a positive attitude through team work. Other objective is to properly formulate functions of random variables applied to engineering problems.

General Learning Outcomes.

At the end of the course students are expected to:

Know and understand the theorems and concepts related to random variables: discrete and continuous, functions of probability distributions, expected values and variance of random variables.

Describe and state numerically the behavior or random variables useful to calculate probabilities in engineering problems.

Contents:	**Hours**
1. General introduction. 1.1. Random variables, samples and events. 1.2. Fundamental axioms. 1.3. Models to enumerate sampling space. 1.4. Addition rules. 1.5. Conditional probability. 1.6. Product laws and dependence of variables. 1.7. Bayes' theorem.	**22**
2. Random variables and probability distributions. 2.1. Random variables. 2.2. Discrete distributions.	**20**

2.3. Expected value and variance. 2.4. Continuous distributions. 2.5. Expected value and variance. 2.6. Joint probability distributions. 2.7. Dependence. 2.8. Functions of random variables. 2.9. Chebyshev's theorem. 2.10. Moments generating functions.	
3. Special discrete functions. 3.1. Uniform. 3.2. Bernoulli. 3.3. Binomial and Multinomial. 3.4. Geometric. 3.5. Hyper geometric. 3.6. Poisson.	**12**
4. Special continuous functions. 4.1. Uniform. 4.2. Exponential. 4.3. Normal.	**10**

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1. Case Analysis to state clearly the accomplishments of the course, properly linked to the real state of contemporary engineering.
2. Cooperative sessions to analyze and solve problems. When could be convenient laboratory sessions are mandatory, of course in presence of Faculty.
3. Learning based on structures and non structured problems. The goal is that students must state, solve and discuss proposals of solutions. They must evidence research and effective communications skills, in full accordance to Institutional Learning Outcomes.
4. Plenary discussions directed by students themselves and also directed by professor. Take care that this is not the only pedagogical strategy to be adopted.
5. Project oriented learning, focused on local requirements of Engineering Science.

6. Visits to companies, in order to gather important information about state of art of the subject. When this strategy could not be pertinent, it can be substituted by conference or Case Analysis.

Assessment:
The student's learning is to be measured under the following criteria:

1. Cooperative attitude, expressed by concrete and measurable actions that will be a clear evidence of the accomplishment of learning outcomes.
2. Engagement, honesty, seriousness, responsibility, attitude of participation and creativity expressed in the furtherance of learning outcomes.
3. Ability and dexterousness expressed in problem solving.
4. Fulfillment of proposed rubrics.
5. Reasonable attendance to class (when required 100% with no failure).

Form	**Instrument**	Percentage
Problem solving	Home works, questionnaires, essays, summaries, documental and data base researches.	35%
Objective tests	At a mid term and a final written exam.	45%
Diverse products	Class project by teams, e-portfolios. Evidence generation, according the nature of subject.	20%
	TOTAL	**100%**

Bibliography

	Type	**Title**	**Author**	**Editorial**	**Year**
1	Text	Probabilidad y estadística con aplicaciones para ingeniería y ciencias computacionales.	J. Susan Milton y Jesé C. Arnold	McGraw-Hill, cuarta edición	2004
2	Reference	Problemario de Probabilidad.	Piotr Marian Wisniewski y Gabriel Velazco Sotomayor	Thomson Learning	2001
3	Reference	Probabilidad y estadística para ingenieros.	Sheldon Ross	McGraw-Hill, segunda edición	2001

Syllabus

Subject: **DIFFERENTIAL EQUATIONS**	**Code:** **MA407**

Curricular location: fourth semester.

Course description.

The course is designed to understand and apply derivatives to model engineering systems, in order to state and discuss a complete solution of the problem, and also the dynamic properties of it. Some topics treated are: first order equations (linear and special non linear cases), higher order equations (linear) and Laplace Transformation. For this course is mandatory a complete domain of Differential and Integral Calculus. The course is necessary to understand Control Theory, Advanced Dynamics, Thermodynamics and Fluid Mechanics.

General Learning Outcomes.

At the end of the course students are expected to:

State, solve, discuss and apply linear and special nonlinear first order differential equations, and also linear equations with constant coefficients of higher order.
Solve and discuss engineering problems using Laplace Transform.
Model engineering situations using appropriate differential equations and give a unique solution.

Contents:	**Hours**
1. General introduction. 1.1 Definitions and terminology. 1.2 Initial value problems. 1.3 Differential equations and modeling.	**8**
2. First order differential equations. 2.1 Initial values. 2.2 Separation of variables. 2.3 Homogeneous equations. 2.4 Exact equations.	**20**

2.5 Linear equations. 2.6 Equation of Bernoulli. 2.7 Change of variables.	
3. Modeling. 3.1 Orthogonal trajectories. 3.2 Linear equations. 3.2 Non linear equations.	**8**
4. Higher order equations. 4.1 Theoretical basis. 4.2 Initial value and boundary value problems. 4.3 Homogeneous equations. 4.4 Non-homogeneous equations. 4.5 Reduction of order. 4.6 Linear equations, constant coefficients. 4.7 Undetermined coefficients. 4.8 Method of Annihilation. 4.9 Variation of parameters.	**14**
5. Laplace's transform. 5.1 Definition. 5.2 Inverse. 5.3 Theorem of translation and transform of derivatives. 5.4 Transforms of integrals and periodical functions. 5.5 Applications. 5.6 Dirac Delta function. 5.7 Systems of linear equations.	**14**

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3. Learning based on structures and non structured problems. The goal is that students must state, solve and discuss proposals of solutions. They must evidence research and effective communications skills, in full

accordance to Institutional Learning Outcomes.

4. Plenary discussions directed by students themselves and also directed by professor. Take care that this is not the only pedagogical strategy to be adopted.
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3. Ability and dexterousness expressed in problem solving.
4. Fulfillment of proposed rubrics.
5. Reasonable attendance to class (when required 100% with no failure).

Form	**Instrument**	Percentage
Problem solving	Home works, questionnaires, essays, summaries, documental and data base researches.	35%
Objective tests	At a mid term and a final written exam.	45%
Diverse products	Class project by teams, e-portfolios. Evidence generation, according the nature of subject.	20%
	TOTAL	**100%**

Bibliography

	Type	Title	Author	Editorial	Year
1	Text	Ecuaciones diferenciales con aplicaciones de modelado	Dennis G. Zill	Editorial Thomson, séptima edición	2002
2	Reference	Ecuaciones diferenciales con problemas de valores frontera	Dennis G. Zill	Editorial Thomson, quinta edición	2002
3	Reference	Elementary Differential Equations	Earl D. Rainville, Phillip E. Bedient y Richard E Bedient	Prentice Hall, 8th.	1996

Syllabus

Subject: PHYSICS III.	**Code:** **FI402**

Curricular location: fourth semester.

Course description:

This is a theoretical – practical course which considers the study of electrical charge, electrical fields, resistive circuits, alternating currents, magnetic fields, Maxwell equations and Optics (elements). The concepts of Vector Analysis studied in Physics I, and the principles of Calculus are indispensable in the course. Handling of trigonometric functions is strongly recommended.

General Learning Outcomes

At the end of the course students are expected to:

Know and understand the principles, related phenomena and interactions between charge and energy, capacitance, electro magnetic fields and magnetic induction.

Construct and analyze resistive, capacitive and inductive circuits and elements.

Construct and analyze optical devices according to contents.

Contents:	**Hours**
1. Electrostatics. 1.1. Introduction. 1.2. Electric charge Coulomb´s law. 1.3. Electric field. 1.4. Gauss's theorem. 1.5. Electric potential.	**14**
2. Capacitance. 2.1. Definition and determination. 2.2. Types of capacitors 2.3. Series and parallel connections. 2.4. Energy stores in capacitors.	**10**

2.5. Dielectric constant and materials.	
3. Electric circuits. 3.1. Electric current and current density. 3.2. Resistivity and conductivity. 3.3. Ohm's law. 3.4. Energy and electrical power. 3.5. Electromotive force. 3.6. Series and parallel connections. 3.7. Kirchoff's laws. 3.8. Node and Mesh analysis. 3.9. Theorem of superposition.	**14**
4. Magnetic phenomena. 4.1. Magnets and fields. 4.2. Magnetic forces on charges. 4.3. Hall effect. 4.4. Biot-Savart's law. 4.5. Ampere´s law. 4.6. Solenoids and toroids. 4.7. Faraday's law of induction. 4.8. Lenz's law. 4.9. Generators and motors. 4.10. Inductance.	**14**
5. Foundations of optics. 5.1. Nature and propagation of light. 5.2. Principles of Optics. 5.3. Reflection and refraction on flat surfaces. 5.4. Mirrors and lenses. 5.5. Interference and diffraction. 5.6. Electromagnetic spectra. 5.7. Polarization. 5.8. LASERS.	**12**

Learning activities: All the activities are individual or by team (general group activities or integrating subgroups). They are classified in activities inside classroom (ICA) or outside classroom (OCA) ones. All ICA's are directed by the corresponding professor or expositor (if it could be convenient). Every OCA would be finished in a completely independent form, but under the proper supervision of Faculty. For every subject the learning activities could be at least the following (or others, similar or higher in pedagogical characteristics):

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2. Cooperative sessions to analyze and solve problems. When could be

convenient laboratory sessions are mandatory, of course in presence of Faculty.

3. Learning based on structures and non structured problems. The goal is that students must state, solve and discuss proposals of solutions. They must evidence research and effective communications skills, in full accordance to Institutional Learning Outcomes.
4. Plenary discussions directed by students themselves and also directed by professor. Take care that this is not the only pedagogical strategy to be adopted.
5. Project oriented learning, focused on local requirements of Engineering Science.
6. Visits to companies, in order to gather important information about state of art of the subject. When this strategy could not be pertinent, it can be substituted by conference or Case Analysis.

Assessment:
The student's learning is to be measured under the following criteria:

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2. Engagement, honesty, seriousness, responsibility, attitude of participation and creativity expressed in the furtherance of learning outcomes.
3. Ability and dexterousness expressed in problem solving.
4. Fulfillment of proposed rubrics.
5. Reasonable attendance to class (when required 100% with no failure).

Form	**Instrument**	Percentage
Problem solving	Home works, questionnaires, essays, summaries, documental and data base researches.	35%
Objective tests	At a mid term and a final written exam.	45%
Diverse products	Class project by teams, e-portfolios. Evidence generation, according the nature of subject.	20%
	TOTAL	**100%**

Bibliography

	Type	Title	Author	Editorial	Year
1	Text	Physics for Scientists and Engineers (with Physics Now and InfoTrac).	Raymond A. Serway, John W. Jewett.	Brooks Cole, 6th.	2003.
2	Reference	Fundamentals of Physics, Volume 2.	David Halliday, Robert Resnik, Jearl Walker	Wiley, 7th	2004
3	Reference	Física - La Naturaleza de Las Cosas Volumen II.	John Burke, Susan M. Lea.	International Thomson Editores.	2001

Syllabus.

Subject:	**Code:**
Mechanics of Materials.	**MC402**

Curricular location: fourth semester.

Course description.

This course is designed to state, solve and discuss problems regarding internal distribution or one and two dimensional systems of forces in solids. It has its foundations in Statics. Stress, strain and deformation are studied as a whole. The course also includes analysis of systems of force in beams, tanks (pressurized) and shafts, axial elements of well known geometries, like circular and polygonal. Some laboratory tests are run to find the final agreement between theoretical and practical cases.

General Learning Outcomes.

At the end of the course students are expected to:

Know and understand the internal interactions of force, moments and distributions inside solid rigid bodies as: shafts, pressurized containers, beams, columns and other subsidiary mechanical elements.
Apply static analysis to design the above elements under particular design restrictions.

Contents	**Hours**
1. Stress and deformations. **1.1. Introduction.** **1.2. Stress.** **1.3. Deformation.** **1.4. Relation stress and deformation.** **1.5. Calculus of deformations.** **1.6. Strains.** **1.7. Welded connections.** **1.8. Screw connectors.**	**12**
2. Pressurized containers. 2.1. Introduction.	**12**

2.2. Forces in cylindrical containers. 2.3. Distribution of stress. 2.4. Spherical containers. 2.5. Design of pressurized containers. 2.6. Connectors.	
3. Torsion. 3.1. Introduction. 3.2. Stress in torsion. 3.3. Torsion angle. 3.4. Design of shafts.	**8**
4. Sharing force and moment diagrams in beams. 4.1. Sharing forces. 4.2. Sketching diagrams. 4.3. Equations. 4.4. Points of inflection. 4.5. Partial diagrams of moments.	**14**
5. Deformation and stress in beams. 5.1. Double integration. 5.2. Conjugated beam. 5.3. Superposition. 5.4. Bending and flections. 5.5. Section Module. 5.6. Design of beams. 5.7. Checking share. 5.8. Checking deformation.	**18**

Learning activities: All the activities are individual or by team (general group activities or integrating subgroups). They are classified in activities inside classroom (ICA) or outside classroom (OCA) ones. All ICA's are directed by the corresponding professor or expositor (if it could be convenient). Every OCA would be finished in a completely independent form, but under the proper supervision of Faculty. For every subject the learning activities could be at least the following (or others, similar or higher in pedagogical characteristics):

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2. Cooperative sessions to analyze and solve problems. When could be convenient laboratory sessions are mandatory, of course in presence of Faculty.
3. Learning based on structures and non structured problems. The goal is that students must state, solve and discuss proposals of solutions. They must evidence research and effective communications skills, in full

accordance to Institutional Learning Outcomes.

4. Plenary discussions directed by students themselves and also directed by professor. Take care that this is not the only pedagogical strategy to be adopted.
5. Project oriented learning, focused on local requirements of Engineering Science.
6. Visits to companies, in order to gather important information about state of art of the subject. When this strategy could not be pertinent, it can be substituted by conference or Case Analysis.

Assessment:
The student's learning is to be measured under the following criteria:

1. Cooperative attitude, expressed by concrete and measurable actions that will be a clear evidence of the accomplishment of learning outcomes.
2. Engagement, honesty, seriousness, responsibility, attitude of participation and creativity expressed in the furtherance of learning outcomes.
3. Ability and dexterousness expressed in problem solving.
4. Fulfillment of proposed rubrics.
5. Reasonable attendance to class (when required 100% with no failure).

Form	**Instrument**	Percentage
Problem solving	Home works, questionnaires, essays, summaries, documental and data base researches.	35%
Objective tests	At a mid term and a final written exam.	45%
Diverse products	Class project by teams, e-portfolios. Evidence generation, according the nature of subject.	20%
	TOTAL	**100%**

Bibliography

	Type	Title	Author	Editorial	Year
1	Text	Mechanics of Materials with Tutorial CD.	Ferdinand P. Beer. E. Russell Johnston y John T. DeWolf.	McGraw-Hill, 3rd.	2001.
2	Reference	Applied Strength of Materials.	Robert L. Mott	Prentice Hall, 4th.	2001.
3	Reference	Mechanics of Materials.	R.C. Hibbeler y Russell C. Hibbeler.	Prentice Hall, 4th.	1999.

Syllabus

Subject:	**Code:**
COMPUTER ASSISTED MACHINING	**MF402**

Curricular location: fourth semester.

Characteristics of the course.

This course is intended to promote in students skills on manufacturing trough engineering drawing comprehension and interpretation, tolerance study, geometrical properties, processing of part machining, budgets of products by manufacturing analysis and handling of advanced computer assisted tooling. Students will be trained in the use and application of CAD interface to operate Numerical Control Machines. A complete domain of Engineering materials is required, and also computer programming skills.

General Learning Outcomes:

At the end of the course students are expected to:

Know and understand: procedures and techniques of manufacturing, budgeting process, system analysis viewpoint, extended drawing techniques to integrate a machining process, Characteristics of tolerance analysis (ANSI 14.5M) and engineering manufacturing plans.

Proceed from an engineering drawing to a CAD/CAM protocol in order to start automated machining using Numerical Control equipment.

Contents:	**Hours**
1. The basics. 1.1. General Introduction. 1.2. General review of concepts of manufacturing and elements. 1.3. Sense of quality of products. 2. General reading of engineering drawings. 2.1. General topics. 2.2. What adjust is convenient? 2.3. Tolerances.	 **12**

2.4. Added and non added dimensional tolerances. 2.5. ANSI Y14.5 M 2.6. Quality in surfaces 2.7. Manufacturing drawings.	**20**
3. Cost Analysis. 3.1. Nature of costs. 3.2. General classification of costs. 3.3. Directs and indirect costs. 3.4. Costing methodology. 3.5. General considerations in machining. 3.6. Operating parameters in manufacturing. 3.7. New machining techniques. 3.8. Costing for usual manufacturing processes.	**16**
4. Numerical control. 4.1. Concepts. 4.2. History. 4.3. Basic components. 4.4. Coordinate systems. 4.5. Systems of control with motion. 4.6. Applications. 4.7. Optimal prizing. 4.8. CNC code and applications.	**16**

Learning activities: All the activities are individual or by team (general group activities or integrating subgroups). They are classified in activities inside classroom (ICA) or outside classroom (OCA) ones. All ICA's are directed by the corresponding professor or expositor (if it could be convenient). Every OCA would be finished in a completely independent form, but under the proper supervision of Faculty. For every subject the learning activities could be at least the following (or others, similar or higher in pedagogical characteristics):

1. Case Analysis to state clearly the accomplishments of the course, properly linked to the real state of contemporary engineering.
2. Cooperative sessions to analyze and solve problems. When could be convenient laboratory sessions are mandatory, of course in presence of Faculty.
3. Learning based on structures and non structured problems. The goal is that students must state, solve and discuss proposals of solutions. They must evidence research and effective communications skills, in full accordance to Institutional Learning Outcomes.
4. Plenary discussions directed by students themselves and also directed by professor. Take care that this is not the only pedagogical strategy to be

adopted.

5. Project oriented learning, focused on local requirements of Engineering Science.
6. Visits to companies, in order to gather important information about state of art of the subject. When this strategy could not be pertinent, it can be substituted by conference or Case Analysis.

Assessment:
The student's learning is to be measured under the following criteria:

1. Cooperative attitude, expressed by concrete and measurable actions that will be a clear evidence of the accomplishment of learning outcomes.
2. Engagement, honesty, seriousness, responsibility, attitude of participation and creativity expressed in the furtherance of learning outcomes.
3. Ability and dexterousness expressed in problem solving.
4. Fulfillment of proposed rubrics.
5. Reasonable attendance to class (when required 100% with no failure).

Form	**Instrument**	Percentage
Problem solving	Home works, questionnaires, essays, summaries, documental and data base researches.	35%
Objective tests	At a mid term and a final written exam.	45%
Diverse products	Class project by teams, e-portfolios. Evidence generation, according the nature of subject.	20%
	TOTAL	**100%**

Bibliography

	Type	Title	Author	Editorial	Year
1	Text	Fundamentals of Tool Design, 5th Edition.	Society of Manufacturing Engineer, John G. Nee.	Society of Manufacturing Engineers, 5th.	2003.
2	Reference	Fundamentals of Modern Manufacturing : Materials, Processes, and Systems.	Mikell P. Groover	Wiley; 2nd.	2003.
3	Reference	CNC Programming Handbook, 2nd Edition.	Peter Smid	Industrial Press, 2nd	2002.

Syllabus

Subject: CALCULUS OF SEVERAL VARIABLES	**Code:** MA406

Curricular location: 5th semester.

Characteristics of the course:

The course will motivate student to develop knowledge, ability and skills required to state, solve and discuss problems involving more than one variable. Parametric equations, polar coordinates, partial differentiation, multiple integration and Lagrange Multipliers optimization technique are studied. Therefore, a complete domain of Calculus id required.

General Learning Outcomes.

At the final of the course students are required to:
Know, understand and solve problems involving polar coordinates and parametric equations.
Know, understand, solve and discuss problems involving several real variables.
Properly interpret and apply partial differentiation.
Determination of maxima and minima of functions of several variables.
Double and triple integration in rectangular, cylindrical and spherical coordinates.
Construct physical prototypes that give absolute evidence of knowledge of several variables functions.
Compare properties of solids and surfaces calculated by several variables integration.

Contents:	**Hours**
1. Polar coordinates. Parametric Equations. 1.1. General introduction. 1.2. Parametric equations, cycloid curves and conical sections. 1.3. Sketch and description of engineering situations using parametric equations. Length of arc. 1.4. Polar coordinates: definition and particular curves. 1.5. Calculus of areas using polar coordinates.	**28**
Differential Calculus of Several Variables. 2.1. Stating the problem under several real variables. 2.2. Partial differentiation, total differential. 2.3. Cylindrical and Spherical coordinates. Jacobians. 2.4. Maxima, minima and saddle point. 2.5. Lagrange multipliers.	**20**
Double and Triple integrals. 3.1. General properties. 3.2. Change of limits and regions of integration. 3.3. Determination of areas, volumes and moments of inertia.	**16**

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2. Cooperative sessions to analyze and solve problems. When could be convenient laboratory sessions are mandatory, of course in presence of Faculty.
3. Learning based on structures and non structured problems. The goal is that students must state, solve and discuss proposals of solutions. They must evidence research and effective communications skills, in full accordance to Institutional Learning Outcomes.
4. Plenary discussions directed by students themselves and also directed by professor. Take care that this is not the only pedagogical strategy to be adopted.
5. Project oriented learning, focused on local requirements of Engineering Science.

6. Visits to companies, in order to gather important information about state of art of the subject. When this strategy could not be pertinent, it can be substituted by conference or Case Analysis.

Assessment:
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2. Engagement, honesty, seriousness, responsibility, attitude of participation and creativity expressed in the furtherance of learning outcomes.
3. Ability and dexterousness expressed in problem solving.
4. Fulfillment of proposed rubrics.
5. Reasonable attendance to class (when required 100% with no failure).

Form	**Instrument**	Percentage
Problem solving	Home works, questionnaires, essays, summaries, documental and data base researches.	35%
Objective tests	At a mid term and a final written exam.	45%
Diverse products	Class project by teams, e-portfolios. Evidence generation, according the nature of subject.	20%
	TOTAL	**100%**

Bibliography

No.	**Type**	**Title**	**Author**	**Editorial**	**Year**
1	Text	Cálculo.	Purcell, Edwin J., Dale Varberg y Steve E, Rigdon.	Pearson Educación.	2001
2	Reference	Cálculo de Varias Variables.	Thomas, George B.	Pearson Educación.	2006.
3	Reference	Cálculo de Varias Variables.	James Stewart.	Thomson Learning.	2001.

Syllabus

Subject: **FLUID MECHANICS**	Code: **MC403**

Curricular location: fifth semester.

Course description:

The course is designed to introduce students in the mathematical and physical concepts necessary to understand flow of Newtonian fluids,

It is important to have a clear idea of Fluid properties and motions to develop projects involving liquids and gases, as will be seen in Pneumatics and Hydraulics.

Finally, fluids are an important aid to generate mechanical optimal systems operating in diverse conditions.

General Learning Outcomes:

At the end of the course students are expected to:

Know:

- How to solve problems involving fluid of constant density in rest.
- How to solve and discuss problems in steady state motion in open or closed channels.
- The application of energy conservation through Bernoulli Equation in fluids in pipes or tubes.
- The dimensional analysis necessary to have a complete idea of the condition of the motion of the fluid.
- State the conditions of stability and good behavior of fluids in engineering systems.

Contents:	**Hours**
General definitions.	
1) Fluids.	**12**
2) Systems of units.	
3) Viscosity.	
4) Continuous media.	
5) Density and specific volume.	
6) Pressure and density.	
7) Perfect gas.	
8) Bulk modulus.	
9) Vapor pressure.	
10) Surface Tension.	
Hydrostatics	
1) Point pressure.	**12**
2) Variation of pressure.	
3) Units.	
4) Manometers.	
5) Forces on plane surfaces.	
6) Components in non plane surfaces.	
7) Buoyancy.	
8) Stability.	
9) Relative Equilibrium.	
Conserved Quantities.	
1) Reynolds' theorem.	**12**
2) Conservation of momentum.	
3) Conservation of Energy.	
4) Bernoulli equation.	
5) Euler and Lagrange theories.	
6) Mass conservation.	
7) Momentum conservation.	
8) Energy conservation.	
Dimensional Analysis.	
1) Dimensional relations.	
2) Units.	**16**
3) Buckingham's Pi theorem.	
4) Adimensional parameters.	
5) Like hood.	
Flux.	
1) Laminar.	
2) Turbulent.	**12**
3) Piping and tubing.	
4) Non circular section flux.	
5) Pressure losses.	
6) Limit layer theory.	
7) Dragging	

Learning activities: All the activities are individual or by team (general group activities or integrating subgroups). They are classified in activities inside classroom (ICA) or outside classroom (OCA) ones. All ICA's are directed by the corresponding professor or expositor (if it could be convenient). Every OCA would be finished in a completely independent form, but under the proper supervision of Faculty. For every subject the learning activities could be at least the following (or others, similar or higher in pedagogical characteristics):

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11. Project oriented learning, focused on local requirements of Engineering Science.
12. Visits to companies, in order to gather important information about state of art of the subject. When this strategy could not be pertinent, it can be substituted by conference or Case Analysis.

Assessment:
The student's learning is to be measured under the following criteria:

6. Cooperative attitude, expressed by concrete and measurable actions that will be a clear evidence of the accomplishment of learning outcomes.
7. Engagement, honesty, seriousness, responsibility, attitude of participation and creativity expressed in the furtherance of learning outcomes.
8. Ability and dexterousness expressed in problem solving.
9. Fulfillment of proposed rubrics.
10. Reasonable attendance to class (when required 100% with no failure).

Form	**Instrument**	Percentage
Problem solving	Home works, questionnaires, essays, summaries, documental and data base researches.	35%
Objective tests	At a mid term and a final written exam.	45%
Diverse products	Class project by teams, e-portfolios. Evidence generation, according the nature of subject.	20%
	TOTAL	**100%**

Bibliography

	Type	**Title**	**Author**	**Editorial**	**Año**
1	Text	Fluid Mechanics, 2002	White, Frank. M.,	McGraw Hill 5th Edition,	2000
2	Reference	Fluid Mechanics with Engineering Applications.	C. Ray Wilye.	McGraw Hill 9th Edition,	2004
3	Reference	Solving Problems in Fluid Mechanics Vol 1 and 2.	J.F. Douglas	Longman Group Limited	1996

Syllabus

Subject: **INTRODUCTION TO MECHANICAL DESIGN**	**Code:** **MC404**

Curricular location: fifth semester.

Characteristics of the course.

This practical course considers distribution of forces, stresses and strains in machine elements, and the application of theories that predict failure. Mechanics of Materials is mandatory as prerequisite. Some particular cases like rotary and rectilinear motion parts are put in practice to be tested under special laboratory conditions.

General Learning Outcomes.

At the end of the course students are required to:

Know and understand the basis of mechanical design, nomenclature and standard language used in the proposal of a design, the general procedure to analyze and state a design problem, theories of failure of machine elements.

Calculate stress in every element of a system, general stress distribution, apply failure theory and machine dimensioning to define safety conditions.

Elaborate a mechanical project using at least springs and screws, with the complete theoretical foundation.

Contents:	Hours
1. Foundations 1.1. General introduction. 1.2. Nomenclature 1.3. Static equilibrium. 1.4. Tension and compression. 1.5. Statically undetermined situations. 1.6. Moment of inertia. 1.7. Bending in beams. 1.8. Principle of superposition.	**18**
2. Variation of stress in solids. 2.1. Analytical method: single point. 2.2. Graphic method: Mohr's circle. 2.3. Stress and deformation in two directions.	**14**
3. Theory of failure. 3.1. Stress and concentration factors. 3.2. Ductile and fragile materials. 3.3. Interpretation and types of failure. 3.4. Safety factors. 3.5. Theory of failure: strength. 3.6. Normal stress. 3.7. Maximum quantities. 3.8. Reversible stress. 3.9. Stable and fluctuant stress. 3.10 Fragile materials.	**14**
4. Shafts. 4.1. Required materials. 4.2. Torsion. 4.3. Power. 4.4. Maximum stress values. 4.5. ASME code. 4.6. Maximum shear. 4.7. Concentration of stress. 4.8. Critical velocity. 4.9. Torsion in noncircular shafts. 4.10. Crankshafts.	**12**
5. Screwed elements. 5.1. Nomenclature. 5.2. Types of screws. 5.3. Analysis of screws.	

5.4. Springs. 5.5. Types of springs. 5.6. Properties of springs. 5.7. Spring materials.	**6**

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3. Learning based on structures and non structured problems. The goal is that students must state, solve and discuss proposals of solutions. They must evidence research and effective communications skills, in full accordance to Institutional Learning Outcomes.
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6. Visits to companies, in order to gather important information about state of art of the subject. When this strategy could not be pertinent, it can be substituted by conference or Case Analysis.

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3. Ability and dexterousness expressed in problem solving.
4. Fulfillment of proposed rubrics.
5. Reasonable attendance to class (when required 100% with no failure).

Form	**Instrument**	Percentage
Problem solving	Home works, questionnaires, essays, summaries, documental and data base researches.	35%
Objective tests	At a mid term and a final written exam.	45%
Diverse products	Class project by teams, e-portfolios. Evidence generation, according the nature of subject.	20%
	TOTAL	**100%**

Bibliography

No.	**Type**	**Title**	**Author**	**Editorial**	**Year**
1	Text	Design of Machine Elements	Spotts, M.F. Shoup, T.E.	Prentice Hall 8th	2003
2	Reference	Design of Machine Elements	Spotts, M.F. Shoup, T.E.	Prentice Hall 7th	1999
3	Reference	Diseño de elementos de maquinas	Mott, Robert L.	Prentice Hall 2da. Edición	1995

Syllabus

Subject: PHYSICAL METALLURGY	Code: **MC405**

Curricular location: sixth semester.

Course characteristics.

The scope of this branch of Materials Science covers two aspects: pure metals and alloys. Three levels of analysis are strongly considered:

- General structure and bulk properties.
- Graphic Analysis and behavior.
- Microstructure.

General Learning Outcomes:
At the end of the course students are expected to:

Discuss the necessity of use pure materials.
State the optimal alloy for every mechanical application.
Link properly the Mechanics of Materials with the graphic behavior of a metallic substance.
State the properties and best applications of steel and its alloys.
Explain the effect of alloying diverse metals.

Generalities.	**Hours**
1. General Introduction. 2. Definitions. 3. Branches of Metallurgy. 4. Macroscopic and Microscopic viewpoint. 5. Structure of matter. 6. Metals and alloys. 7. Solidification. 8. 2 Phase equilibrium diagram for alloys. 9. Cooling curves. 10. General rules of phase transition.	**20**

11. Transformation reactions. **Alloys** 1. Steel -Carbon. 2. Other steels. 3. Equilibrium diagram. 4. Phase transformation and structures. 5. Effect of other elements. 6. Critical Temperature. 7. Melting and cooling of metals. 8. Thermal treatment (TT). 9. Change of properties undet TT. 10. Critical Diameter.	**20**
Failure 1. Classification. 2. Macro and microstructures. 3. Hypothesis. 4. Technical Reports.	**24**

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8. Cooperative sessions to analyze and solve problems. When could be convenient laboratory sessions are mandatory, of course in presence of Faculty.
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8. Ability and dexterousness expressed in problem solving.
9. Fulfillment of proposed rubrics.
10. Reasonable attendance to class (when required 100% with no failure).

Form	**Instrument**	Percentage
Problem solving	Home works, questionnaires, essays, summaries, documental and data base researches.	35%
Objective tests	At a mid term and a final written exam.	45%
Diverse products	Class project by teams, e-portfolios. Evidence generation, according the nature of subject.	20%
	TOTAL	**100%**

Bibliography

	Type	**Title**	**Author**	**Editorial**	**Year**
1	Text	Metallurgy Fundamentals.	Daniel A. Brandt, J. C. Warner	Goodheart-Wilcox Publisher.	2001
2	Reference	Physical Metallurgy	Peter Haasen, B. L. Mordike	Cambridge University Press; 3 edition	2000
3	Reference	Physical Metallurgy Principles.	Reed-Hill, R. E., and R. Abbaschian.	3rd ed. Boston: PWS-Kent,	1992

Course program

Course name: Advanced communication in English	**Course ID:** ID400

Placement in curricular map: fifth semester

Course characteristics: This course represents another space through which the internationalization profile of all majors in CETYS Universidad is fostered. In this course English is the object of study, but from the perspective of professional practice. In this course students will have the opportunity to importantly improve their mastery of English language, mainly through an intensive approach on speaking and writing. This course involves a series of learning activities through which students will have to use English in typical labor conditions in the professional exercise, as well as social interaction, looking for the improvement of their oral expression as well as the increase of the use of conventional vocabulary related to their major. On the other hand, this course is critical for students that are interested in participating in academic exchange programs with overseas universities where English is the official language. This course demands from participants a positive attitude towards cooperative and collaborative learning, ability to work in groups and a commitment with the continuous improvement of their English language mastery.

General learning objectives:
At the end of this course students will:

Master English language in terms of writing and speaking it correctly in such way that they can keep on improving in the use of this language.
Understand the importance of this language in their professional exercise and specifically in activities in which English is frequently used.
Use different sources of information that can help them update the technical vocabulary in their respective professional area.
Apply the terminology related to the professional practice of their major.
Follow up a job interview, as well as meetings and presentations in English in a fluent way.
Formulate their resume in English, as well as other legal or work documents related to the practice of their major.
Employ correctly and widely the vocabulary related to their major.

Contents:	**Hours**
Unit 1. English in the workplace, people and organizations. 1.1. Introduction and course set up.	**16**

1.2. Structures of organizations. 1.3. Work, forms of work and the people at the workplace. 1.4. Managerial styles and business leaders. 1.5. Personnel recruiting and selection: Skills and competencies.	
Unit 2. English in the functional areas of a company. 2.1. Marketing, markets and competence. 2.2. Product design, innovation and development. 2.3. Materials, suppliers and production. 2.4. Money of finances and economy. 2.5. Business philosophy.	**16**
Unit 3. English in business and personal skills. 3.1. Time and its administration 3.2. Stress and its administration. 3.3. Meetings, group work and presentations. 3.4. Negotiation skills. 3.5. Telephone calls, fax and e-mail.	**16**
Unit 4. English in culture and organizational values. 4.1. Cultures and organizational cultures. 4.2. Authority management and distance in cultures. 4.3. Customs in cross-cultural businesses. 4.4. Acquisitions and corporate alliances. 4.5. Corporate and product image.	**16**

Learning activities:

Learning experiences in this course will be of an individual and group character. Some of them will be in the classroom with the instruction and other will be independent to be carried out by students out of the classroom. Those performed by students will be in the form of:

Collaborative work in the classroom to analyze and debate on the contents under the instructor's supervision

Method of cases to apply and assess the reach and limitations of the course contents

Cooperative work out of the classroom for the analysis of cases and solution of problems

Learning based on structure and non-structured problems so students can formulate problems and apply the course contents in the generation of solutions, either from individual efforts or as a result of teamwork starting from brainstorming

Presentation of contents by instructor, avoiding at all cost its becoming a costume throughout the course.

Learning based on application projects by teams so students can apply their knowledge on projects.

Assessment procedures and criteria:

Students performance through the course will be based on the following criteria

The manifested willingness and cooperation with concrete actions to achieve the learning objectives of each unit of the course's general objective.

The manifested commitment, honesty, seriousness, responsibility, quality, participation and creativity when executing all learning activities developed throughout the course.

The manifested ability and dexterity to solve the specific problems throughout the course.

Students performance thought the course will be based on the following criteria:

Form	Instrument	Percentage
Interrogation and problem solving	Individual and group assignments in the form of questionnaires, essays, summaries, structured problems to solve, and bibliographical or internet research.	35%
Problem solving	Individual objective tests: Partial and final exam.	45%
Product request	Application, documental or field research and individual or group report of the project.	20%
	TOTAL	**100%**

Bibliography

	Type	**Title**	**Author**	**Publisher**	Year
1	Text	Business Vocabulary in Use Advanced.	Bill Mascull.	Cambridge University Press.	2004.
2	Reference	Business Vocabulary in Use intermediate.	Bill Mascull.	Cambridge University Press.	2002.
3	Reference	Common American Phrases in Everyday Contexts: A Detailed Guide to Real-Life Conversation and Small Talk.	Richard A. Spears.	McGraw-Hill, segunda edición.	2002.

Syllabus

Subject: FINITE MODELING.	Code: **MC406**

Curricular location: sixth semester.

Course description.

COSMOS/M, COSMOSWORKS, y/o ANSYS are common software systems to analyze, design and understand the behavior of mechanical complex systems. These computer systems, similar or higher will be known and applied by student to generate designs in complete agreement with required prescribed specifications. The problem will start with classical design requirements and their integration in variables and packages of variables to simulate properly the optimal operating conditions.

General learning outcomes:

At the end of the course students are expected to:

Reduce a complex design problem into simple parts.

State and apply the correct numerical procedure to analyze the system.

Understand the pertinence and viability of the selected method of analysis.

Understand the state and discuss the internal forces, stresses and pressures developed in a solid under the prescribed work conditions.

Apply finite method procedure in linear distribution systems.

General Introduction.	**Hours**
1. Basic concepts. 2. Discretization. 3. Finite differences. 4. Finite elements.	**8**

Discrete modeling. 1. Concept of Discretization. 2. Vibrations. 3. Modes and frequencies. 4. Transverse vibrations. 5. Torsional vibrations. 6. Axial vibrations. 7. Application example. 8. Graeffe's method. 9. Faddevv Leverrier's method.	**24**
Structures and trusses 1. Minimal energy. 2. Energy of deformation. 3. Axial force systems. 4. Matrix notation.	**18**
Finite differences. 1. One-dimensional heat conduction. 2. Boundary conditions. 3. Heat Flux. 4. Convection. 5. Special elements. 6. Bidimensional transfer. 7. Transient state flux. 8. Stability.	**14**

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8. Ability and dexterousness expressed in problem solving.
9. Fulfillment of proposed rubrics.
10. Reasonable attendance to class (when required 100% with no failure).

Form	**Instrument**	Percentage
Problem solving	Home works, questionnaires, essays, summaries, documental and data base researches.	35%
Objective tests	At a mid term and a final written exam.	45%
Diverse products	Class project by teams, e-portfolios. Evidence generation, according the nature of subject.	20%
	TOTAL	**100%**

Bibliography

	Type	Title	Author	Editorial	Year
1	Text	Concepts and Applications of Finite Element Analysis.	Robert D Cook	Wiley. 4th Ed	2001
2	Reference	Applied Finite Element Analysis	Larry J. Segerlind	Wiley. 2nd Edition	2001
3	Reference	A First Course in the Finite Element Method	Daryl L. Logan	Thomson	2000

Syllabus

Subject: ELECTROPNEUMATICS AND HYDRAULICS.	Code: MC407

Curricular location: sixth semester.

Description of the course.

The course is intended to guide students to understand and apply solenoids, actuators, motors, pumps, compressors, pistons, valves and accessories to the design of complex motion systems. Topics on sequential control and system design software are developed in detail. Simulation of automatic controlled systems is practiced also.

General Learning Outcomes.

At the end of the course students are expected to:

Understand, apply and test principles of electro pneumatic and pneumatic principles, real and Ideal Gases laws, servo valves, compression of real and ideal gases, uniphilar diagrams.

Develop pneumatic systems with manual controls and automatic controls.

- Develop systems for linear motion, angular motion and definite mechanisms.

Contents:	Hours
1. Newtonian fluids. 1.1 Definitions. 1.2 Units and dimensions. 1.3 Viscosity. 1.4 Continuous media. 1.5 Density, volume, relative density and pressure. 1.6 Ideal gases. 1.7 Bulk modulus for gases. 1.8 Vapor pressure. 1.9 Surface tension. 1.10 One point pressure. 1.11 Variations of pressure in fluids at rest. 1.12 Pressure units. 1.13 Manometers. 1.14 Force on plane areas. 1.15 Components of pressure forces on surfaces. 1.16 Hydrostatic forces. 1.17 Buoyancy. 1.18 Relative equilibrium.	14
2. Principles of Pneumatics 2.1 Definitions. 2.2 Air generators. 2.3 Accumulators. 2.4 Tubes and pipes. 2.5 Techniques of pressurized air. 2.6 Work and control elements.	14
3. Pneumatic actuators 3.1 Actuators. 3.2 Valves. 3.3 Control elements. 3.4 Design considerations.	24
4. Electrical systems 4.1 Basic concepts, 4.2 Electric circuits. 4.3 Electromagnetic phenomena. 4.4 Electro pneumatic components. 4.5 Design of circuits. Appendix 1: Glossary. Appendix 2: Symbolisms	12

Learning activities: All the activities are individual or by team (general group activities or integrating subgroups). They are classified in activities inside classroom (ICA) or outside classroom (OCA) ones. All ICA's are directed by the corresponding professor or expositor (if it could be convenient). Every OCA would be finished in a completely independent form, but under the proper supervision of Faculty. For every subject the learning activities could be at least the following (or others, similar or higher in pedagogical characteristics):

1. Case Analysis to state clearly the accomplishments of the course, properly linked to the real state of contemporary engineering.
2. Cooperative sessions to analyze and solve problems. When could be convenient laboratory sessions are mandatory, of course in presence of Faculty.
3. Learning based on structures and non structured problems. The goal is that students must state, solve and discuss proposals of solutions. They must evidence research and effective communications skills, in full accordance to Institutional Learning Outcomes.
4. Plenary discussions directed by students themselves and also directed by professor. Take care that this is not the only pedagogical strategy to be adopted.
5. Project oriented learning, focused on local requirements of Engineering Science.
6. Visits to companies, in order to gather important information about state of art of the subject. When this strategy could not be pertinent, it can be substituted by conference or Case Analysis.

Assessment:
The student's learning is to be measured under the following criteria:

1. Cooperative attitude, expressed by concrete and measurable actions that will be a clear evidence of the accomplishment of learning outcomes.
2. Engagement, honesty, seriousness, responsibility, attitude of participation and creativity expressed in the furtherance of learning outcomes.
3. Ability and dexterousness expressed in problem solving.
4. Fulfillment of proposed rubrics.
5. Reasonable attendance to class (when required 100% with no failure).

Form	**Instrument**	Percentage
Problem solving	Home works, questionnaires, essays, summaries, documental and data base researches.	35%
Objective tests	At a mid term and a final written exam.	45%
Diverse products	Class project by teams, e-portfolios. Evidence generation, according the nature of subject.	20%
	TOTAL	**100%**

Bibliography

No.	**Type**	**Title**	Author	**Editorial**	**Year**
1	Text	Pneumatic Actuating Systems for Automatic Equipment	Igor Lazar Krivtsun, German V. Krejnin	CRC Press ISBN: 0849329647	2006
2	Reference	Hydraulics and Pneumatics	Andrew Parr	Butterworth-Heinemann ISBN: 0750644192	1999
3	Reference	Basic Pneumatics	Jay F. Hooper	Carolina Academic Press ISBN: 0894649655	2003

Syllabus

Subject: THERMODYNAMICS	Code: **MC408**

Curricular location: sixth semester.

Characteristics of the course.

This is a theoretical practical course in which issues like volume and mass controls are applied to understand the viable direction and thermal behavior of mechanical processes. Three (and zeroth) laws of thermodynamics are considered to state the operating conditions which could be possible with the corresponding calculus of the determinant variables: Temperature, pressure, internal energy and thermodynamic potentials.

General Learning Outcomes.
At the end of the course students are expected to:

Define correctly the conditions of operation of thermometers and thermometric scales and devices appropriate in engineering systems.

Solve and discuss the energy conservation of systems which are affected by heat and work exchange.

Determine the thermodynamic potentials that permit the correct prediction of the direction of a process.

Understand cryogenics and low temperature technologies.

Basics.	**Hours**
1.1 General Introduction. 1.2 Basic concepts: work (simple substances $dW = XdY$) 1.3 Zeroth law. 1.4 Overview of the three laws.	**6**

Work 2.1 Definition. 2.2 Units. 2.3 Reversible and irreversible work. 2.4 Heat. 2.5 Units. 2.6 Comparison between Heat and Work. First Law of thermodynamics. 3.1 System without cycling. 3.2 Change of state. 3.3 Internal Energy. 3.4 Heat transfer rate. 3.5 Conservation of mass. 3.6 Control mass and volume. 3.7 First law for control volume. 3.8 Enthalpy. 3.9 Steady state regime. 3.10 Uniform flux. 3.11 Constant pressure phenomena. Second law of thermodynamics. 4.1 Thermal machines. 4.2 Second law. 4.3 Reversible process. 4.4 Irreversibility. 4.5 Carnot's Cycle. 4.6 Efficiency. Entropy 5.1 Definition. 5.2 Irreversibility. 5.3 Availability.	**12** **24** **12** **10**

Learning activities: All the activities are individual or by team (general group activities or integrating subgroups). They are classified in activities inside classroom (ICA) or outside classroom (OCA) ones. All ICA's are directed by the corresponding professor or expositor (if it could be convenient). Every OCA would be finished in a completely independent form, but under the proper supervision of Faculty. For every subject the learning activities could be at least the following (or others, similar or higher in pedagogical characteristics):

7. Case Analysis to state clearly the accomplishments of the course, properly linked to the real state of contemporary engineering.

8. Cooperative sessions to analyze and solve problems. When could be convenient laboratory sessions are mandatory, of course in presence of Faculty.
9. Learning based on structures and non structured problems. The goal is that students must state, solve and discuss proposals of solutions. They must evidence research and effective communications skills, in full accordance to Institutional Learning Outcomes.
10. Plenary discussions directed by students themselves and also directed by professor. Take care that this is not the only pedagogical strategy to be adopted.
11. Project oriented learning, focused on local requirements of Engineering Science.
12. Visits to companies, in order to gather important information about state of art of the subject. When this strategy could not be pertinent, it can be substituted by conference or Case Analysis.

Assessment:
The student's learning is to be measured under the following criteria:

6. Cooperative attitude, expressed by concrete and measurable actions that will be a clear evidence of the accomplishment of learning outcomes.
7. Engagement, honesty, seriousness, responsibility, attitude of participation and creativity expressed in the furtherance of learning outcomes.
8. Ability and dexterousness expressed in problem solving.
9. Fulfillment of proposed rubrics.
10. Reasonable attendance to class (when required 100% with no failure).

Form	**Instrument**	Percentage
Problem solving	Home works, questionnaires, essays, summaries, documental and data base researches.	35%
Objective tests	At a mid term and a final written exam.	45%
Diverse products	Class project by teams, e-portfolios. Evidence generation, according the nature of subject.	20%
	TOTAL	**100%**

Bibliography

	Type	**Title**	**Author**	**Editorial**	**Year**
1	Text	Thermodynamics an Engineering Approach.	Cengel Y.A., Boles M.A.,	McGraw-Hill. 4th.	2001
2	Reference	Thermodynamics	Wark K., Richards D.E	McGraw-Hill	1999
3	Reference	Fundamental of Classical Thermodynamics	Van Wylen, G.J. y Sonntag R.E.,	Wiley	1985

CETYS UNIVERSIDAD

Course program

Course name: Scientific Method	**Course ID:** CS402

Placement in curricular map: sixth semester

Course characteristics:
To develop in students a solid information platform to create basic research processes on topics related to their major labour market.

General learning objectives:
At the end of the course students will:

Apply research fundamental models.
Design a system to identify in different cases the problems inherent to research vulnerable areas.
Construct: information analysis. Discriminating among relevant and irrelevant data.
Elaborate a written assignment establishing a research problem including: definition of the problem, objectives, justification and delimitation.
Construct the research theoretical framework mentioned in the previous paragraph.
Operate the research hypothesis, defining variables, indicators, measurement, population and sample instruments.
Elaborate a research report
Apply a strategy that allows making adequate source detection, discarding, based on their methodological principles, the ones that are not reliable.
Defend the importance of scientific research in a professional area.
Elaborate an entrepreneurial project according to the class process following the appropriate methodology. Such project will be carried out physically and will be presented in the institution facilities

Contents:	**Hours**
	13
Unit 1 Problem identification. 1.1 Science and the professional. 1.2 Ways to approach knowledge. 1.3 Topics that can be researched. 1.4 Research approaches. 1.5 Research models. 1.6 Stating the problem. 1.7 Cases and application problems.	
	13
Unit 2 Research theoretical framework 2,1 Recollection of documental information. 2.2 Recollection of empirical data. 2.3 Elaboration of the theoretical framework. 2.4 Cases and application projects	
	13
Unit 3 Hypothesis 3.1 Determination of the hypothesis. 3.2 Sampling. 3.3 Elaboration of the data recollection instrument. 3.4 Study of cases and applications	**13**
Unit 4 Final report. 4.1 Information processing using SPSS 4.2 Elaboration of research reports. 4.3 Study of cases and applications	**12**
Unit 5 Project: development of an entrepreneurial model 5.1 Exploration of the entrepreneurial model. 5.2 Selection of the entrepreneurial project. 5.3 Development of the entrepreneurial project. 5.4 Presentation of the entrepreneurial project. 5.5 Assessment of the entrepreneurial project.	

Learning activities:

Learning experiences in this course will be of an individual and group character. Some of them will be in the classroom with the instruction and other will be independent to be carried out by students out of the classroom. Those performed by students will be in the form of:

1. Collaborative work in the classroom to analyze and debate on the contents under the instructor's supervision

2. Method of cases to apply and assess the reach and limitations of the course contents

3. Cooperative work out of the classroom for the analysis of cases and solution of problems

4. Learning based on structure and non-structured problems so students can formulate problems and apply the course contents in the generation of solutions, either from individual efforts or as a result of teamwork starting from brainstorming

5. Presentation of contents by instructor, avoiding at all cost its becoming a costume throughout the course.

6. Learning based on application projects by teams so students can apply their knowledge on projects.

Assessment procedures and criteria:

Students performance through the course will be based on the following criteria

1. The manifested willingness and cooperation with concrete actions to achieve the learning objectives of each unit of the course's general objective.

2. The manifested commitment, honesty, seriousness, responsibility, quality, participation and creativity when executing all learning activities developed throughout the course.

3. The manifested ability and dexterity to solve the specific problems throughout the course.

Students performance through the course will be based on the following criteria:

Form	**Instrument**	**Percentage**
Interrogation and problem solving	Individual and group assignments in the form of questionnaires, essays, summaries, structured problems to solve, and bibliographical or internet research.	35%
Problem solving	Individual objective tests: Partial and final exam.	45%
Product request	Application, documental or field research and individual or group report of the project.	20%

Bibliography:

	Type	**Title**	**Author**	**Publisher**	**Year**
1	Text 1	Metodología de la Investigación	Roberto Hernández S., Carlos Fernández C. Pilar Baptista L.	McGraw-Hill	2003
2	Text 2	Metodología de la Investigación	Maurice Eyssautier de la Mora	Thomson	2006
3	Text 3	Técnica de la Investigación documental	Yolanda Jurado Rojas	Thomson	2002

Course Program

Course Name: Man and Environment	**Course ID** HU400

Location in the curricular map: sixth semester

Course characteristics:
This course is focused on the reflection of how men are related to their natural environment and it analyzes the changes in the environment as a result of men's activities. Students are expected to look for and develop mechanisms to improve these changes, perceive the planet's self regulatory capacity and value themselves as capable of modifying the environment in different directions. The fundamental values to promote are: observation, tolerance, communication and respect for those who are different from us.

General learning objectives:
At the end of this course the student is expected to:
Know the impact that the human being has on the environment with the dominating development and **apply** an environmental-educational proposal that will improve the relation man-society-nature in a specific time.
Design alternate development models to value and achieve an adequate social sustainability towards natural spaces.
Build a commitment formula that reflects a personal and professional responsibility when transforming the environment.
Develop a serious and profound review of the context and establish priorities freely as an individual that is part of a society, always pursuing the well being of others in order to get closer to society and the environment.

Thematic Content:	**Hours**
Unit 1 Getting close with regional environment 1 Natural landscaping ▪ The region's ecosystems ▪ The value of the regional ecosystems 2 Transforming landscapes ▪ The city's first decades ▪ Expansion and development ▪ Current situation 3 Environmental crisis	20

▪ Population growth ▪ Economical diversity and environment ▪ Environmental impact 4 Solutions to the environmental crisis ▪ Protected Natural Areas (PNA)	
Unit 2 Serious Environmental Problems of Modern Life 1 Historical appropriation of natural spaces ▪ Upper Paleolithic ▪ The Neolithic and the beginning of the environmental crisis ▪ The message of Chief Seattle ▪ Entering modern life 2 Modern Life's Environmental Crisis ▪ Human Population ▪ Human Consumption ▪ The Loss of Bio-diversity ▪ Climatic Demonstrations 3 Habitability ▪ Characteristics ▪ Cases of habitable cities	28
Unit 3 Environmental Education for Sustainable Development 1 Environmental education ▪ International encounters ▪ Characteristics of environmental education ▪ Environmental projects 2 Sustainable Development ▪ Focus on sustainability: economical, ecological and social-political ▪ The role of the government ▪ The case of a sustainable culture: the Mayas 3 Environmental Values	16

Learning activities: The learning experience in this course will be individual and in groups; some directed by the instructor and others will be carried out individually by the students outside the classroom. Those carried out by the students will be held in the following way:

1. Collaborative work inside the classroom to analyze and debate over the contents directed by the instructor.
2. Case methods to apply and evaluate the scope and limitations of the course contents.
3. Cooperative work outside the classroom to analyze cases and problem solution.
4. Learning based on structured and non-structured problems so the students learn to formulate problems and apply the course contents by generating solutions, working individually as well as in teams, starting from brainstorming.
5. Contents presentation by the instructor, avoiding at all costs its becoming a custom throughout the course.
6. Learning based on application projects in teams, so the students apply their knowledge in projects of their own interest.

Assessment criteria and procedures:
Students' performance throughout the course will be based on the following criteria:
(7) The availability and cooperation manifested in concrete actions to achieve the learning objectives in each unit and the course's general objectives.
(8) The commitment, honesty, seriousness, responsibility, quality, participation and creativity manifested when executing all learning activities developed throughout the course.
(9) The ability and dexterity manifested to solve specific problems throughout the course.

Considering the criteria before mentioned, an assessment form is proposed:

Form	**Instrument**	Percentage
Problem questioning and solution	Individual and team tasks, such as questionnaires, essays, summaries, structured problems to solve and bibliographic or internet research.	35%
Problem solving	Individual objective tests: part exams and one final exam.	45%
Product request	Application, documental or field	20%

	research project and a team report of the project.	
	TOTAL	**100%**

Bibliography

	Type	Title	Author	Publisher	Year
1	Text 1	Environmental Sciences. Ecology and Sustainable Development	Bernard Nebel, Richard Wright	Pearson Prentice Hall	1999
2	Text 2	Environmental Science and Sustainable Development	Ernesto Enkerlin	Thomson	1997
3	Text 3	Environmental Science Preserving Earth	G. Tyler Miller	Thomson	2002
4	Reference	Ecology and Environment	G. Tyler Miller	Iberoamericana	1994

Syllabus

Subject: MECHANICAL DESIGN ENGINEERING	Code: **MC409**

Curricular location: seventh semester.

The course is designed to the determination, analysis and selection of machine elements as gears assemblies, chains, bands, brakes and clutches. Students will use software systems to model properly not just elements, but complete systems.

General Learning Outcomes.
At the end of the course students are expected to:

Design a complete mechanical system employing at least: complex gear assemblies of diverse geometries, chain linked transmissions, properly implemented brake – clutch systems.

Make proper use of computational systems like pro-E, similar or higher in engineering resolution capabilities.

Contents:	**Hours**
Gears 1. Types of gears. • General concepts. • Properties. • Capacities. 2. Conic and Helicoidal gears. • Nomenclature • Capacity. 3. Clasification. 4. Geometrical relations.	**8**
Bands 1 V-bands. 2. Design for pulleys. 3. Capacities. 4. Contacta Angle. 5. Jagged bands.	**10**

Chains 1. Transmissions. 2. Capacities. 3. Lubrication. 4. Silent chains.	**10**
Metallic cables. 1. General conditions. 2. Transmision. 3. Pulleys.	**12**
Clutches. 1. Disk. 2. Conical. 3. Friction coefficient. 4. Capacities.	**12**
Brakes 1. Disc. 2. Brake shoe. 3. Belt brakes. 4. Friction coupling.	**12**

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14. Cooperative sessions to analyze and solve problems. When could be convenient laboratory sessions are mandatory, of course in presence of Faculty.
15. Learning based on structures and non structured problems. The goal is that students must state, solve and discuss proposals of solutions. They must evidence research and effective communications skills, in full accordance to Institutional Learning Outcomes.
16. Plenary discussions directed by students themselves and also directed by professor. Take care that this is not the only pedagogical strategy to be adopted.
17. Project oriented learning, focused on local requirements of Engineering Science.
18. Visits to companies, in order to gather important information about state of art of the subject. When this strategy could not be pertinent, it can be

substituted by conference or Case Analysis.

Assessment:
The student's learning is to be measured under the following criteria:

11. Cooperative attitude, expressed by concrete and measurable actions that will be a clear evidence of the accomplishment of learning outcomes.
12. Engagement, honesty, seriousness, responsibility, attitude of participation and creativity expressed in the furtherance of learning outcomes.
13. Ability and dexterousness expressed in problem solving.
14. Fulfillment of proposed rubrics.
15. Reasonable attendance to class (when required 100% with no failure).

Form	**Instrument**	Percentage
Problem solving	Home works, questionnaires, essays, summaries, documental and data base researches.	35%
Objective tests	At a mid term and a final written exam.	45%
Diverse products	Class project by teams, e-portfolios. Evidence generation, according the nature of subject.	20%
	TOTAL	**100%**

Bibliography

	Type	**Title**	**Author**	**Editorial**	**Year**
1	Text	Design of Machine Elements	M.F. Spots	Prentice Hall	1988
2	Reference	Diseño de elementos mecánicos	Robert L. Mott	Prentice Hall	2000
3	Reference	Diseño en Ingeniería Mecánica	Joseph Shigley	Mc Graw Hill	1999

Syllabus

Subject: DYNAMICS OF MECHANISMS	**Code:** MC410

Curricular location: 7th semester.

In this course students will analyze and synthesize cams, meshes, shafts, screws, fasteners and nonpermanent joints. Gears, clutches, brakes, couplings and flywheels are also considered as engineering systems. Vibratory systems and balancing is a very important topic treated among others.

General Learning Outcomes.

At the end of the course students are expected to:

Know, understand and apply kinematical design of mechanisms as cranks, 4 bar, mesh, cams, forces that produce vibrations.
Apply foundations of design and applications to develop mechanical prototypes.
Practice balance of rotors with a computer assisted equipment.

Contents:	Hours
1. Introduction. Transmission of motion. 4 bar mechanisms. Grashoff's law. Angular speed of direct contact members. Crank set systems.	8
2. Analytical design of mechanisms: Cams. Cylindrical mesh, involumetrics and nomenclature. Conical mesh. Crowns.	12

3. Synthesis. Precision space of points. Generating function of 4 bar system. Design for instant values of angular acceleration and velocity.	14
4. Kinematics of machines. Single particle motion. Linear. Angular. Relative. Velocity and acceleration methods. Vector Methods. Instant center. Kennedy's theorem. Coriolis' acceleration. Complex variable analysis.	12
5. Mechanical vibrations. Natural. Forced. Amplitude. Transmissibility. Damping. Out of center rotation of shafts. Natural frequency and critical velocity. Natural frequency of shafts with masses. Shafts of variable diameter. Critical velocity of higher order. Torsion vibrations. Step shafts. Torsion with mesh.	8
6. Machinery balance. Rotors. Static and Dynamic. Machines which can be balanced. Reciprocating machines. Analytical determination of balance. Computer assisted balance.	10

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2. Cooperative sessions to analyze and solve problems. When could be convenient laboratory sessions are mandatory, of course in presence of Faculty.
3. Learning based on structures and non structured problems. The goal is that students must state, solve and discuss proposals of solutions. They must evidence research and effective communications skills, in full accordance to Institutional Learning Outcomes.
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6. Visits to companies, in order to gather important information about state of art of the subject. When this strategy could not be pertinent, it can be substituted by conference or Case Analysis.

Assessment:
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3. Ability and dexterousness expressed in problem solving.
4. Fulfillment of proposed rubrics.
5. Reasonable attendance to class (when required 100% with no failure).

Form	**Instrument**	Percentage
Problem solving	Home works, questionnaires, essays, summaries, documental and data base researches.	35%
Objective tests	At a mid term and a final written exam.	45%
Diverse products	Class project by teams, e-portfolios. Evidence generation, according the nature of subject.	20%
	TOTAL	**100%**

Bibliography

	Type	**Title**	**Author**	**Editorial**	**Year**
1	Text	Mechanisms and Dynamics of Machinery,	Mabie and Reinholtz	Wiley	1987
2	Reference	Kinematic Synthesis of Linkages	Hartenberg and Denvit	Mc Graw Hill	1964
3	Reference	Kinematics, Dynamics, and Design of Machinery	Kenneth, Waldron, Gary,	Wiley	1999
4.	Reference	Design of Machinery	Robert L. Norton	Mc Graw Hill	2003
5,	Reference	Introduction to Mechanical Vibrations	Robert F. Steidel	Wiley	2001

Syllabus

Subject: **AUTOMATION AND CONTROL**	Code: **MC403**

Curricular location: seventh semester.

Course description:

This course reinforces students' skills in industrial automation, control systems and instrumentation and notions of PLCs. Also students learn about hardware and software useful in the setting up and configuration of the complete system (PLC and peripherals). It is mandatory to consider an Industrial application and completely solve it. If it were not possible a laboratory prototype must be generated

General Learning Outcomes:

At the end of the course students are expected to:

- Plan, design, analyze, install and test an automation system.
- Create a prototype according to the demands of an industrial problem.
- Discuss an optimal proposal for an automation system.
- State the characteristics of peripherals required for a PLC based automation system.

Introduction. 1.1 Preliminaries. 1.2 Technologies. 1.3 Integration of solutions. 1.4 Previous considerations before automation. 1.5 Applications.	**Hours** **12**

Control systems. 2.1 Introduction. 2.2 Terminology. 2.3 Feedback. 2.4 Sensors and actuators. 2.5 Data acquisition. 2.6 Signal conditioning. 2.7 Software systems. 2.8 Applications. **PLCs** 3.1 Introduction. 3.2 Definitions. 3.3 Sequential control. 3.4 Circuital and programmed setting up. 3.5 Ladder diagrams. 3.6 PLCs. 3.7 Architecture. 3.8 Programming. 3.9 Solutions which require PLCs. 3.10 Correct selection. 3.11 Applications.	**24** **28**

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14. Cooperative sessions to analyze and solve problems. When could be convenient laboratory sessions are mandatory, of course in presence of Faculty.
15. Learning based on structures and non structured problems. The goal is that students must state, solve and discuss proposals of solutions. They must evidence research and effective communications skills, in full accordance to Institutional Learning Outcomes.
16. Plenary discussions directed by students themselves and also directed by

professor. Take care that this is not the only pedagogical strategy to be adopted.

17. Project oriented learning, focused on local requirements of Engineering Science.
18. Visits to companies, in order to gather important information about state of art of the subject. When this strategy could not be pertinent, it can be substituted by conference or Case Analysis.

Assessment:
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12. Engagement, honesty, seriousness, responsibility, attitude of participation and creativity expressed in the furtherance of learning outcomes.
13. Ability and dexterousness expressed in problem solving.
14. Fulfillment of proposed rubrics.
15. Reasonable attendance to class (when required 100% with no failure).

Form	**Instrument**	Percentage
Problem solving	Home works, questionnaires, essays, summaries, documental and data base researches.	35%
Objective tests	At a mid term and a final written exam.	45%
Diverse products	Class project by teams, e-portfolios. Evidence generation, according the nature of subject.	20%
	TOTAL	**100%**

Bibliography

	Type	Title	Author	Editorial	Year
1	Text	Sistemas de Control Secuencial y Fundamentos de PLCs	Sosa López, Jorge	Colección de Ingeniería CETYS Univerisdad	2006
2	Reference	Automation, production systems and Computer Integrated Manufacturing;	Groover, Mikell P.	Prentice Hall	2004
3	Reference	Control Systems Engineering	Nise, Norman S.	Wiley & Sons	2000

Course program

Course name: Human Being, History and Society	**Course ID:** HU401

Placement in curricular map: Seventh Semester

Course characteristics:
Develop in students the recognition of human beings as an entity that develops in history and society; in history in different times and spaces and with diverse cultural traits to know how to take advantage of the collective experience that precedes us; and in society where they are located as a social subject looking for the assessment of some contemporary social manifestations and their revised future consequences, all of this with the idea that students can make a reflection that helps them place themselves in their reality to take a more conscious responsibility of their future.

General learning objectives:
At the end of this course students will:

Apply mechanisms that allow them to identify and reconstruct their vision of men and contemporary and future society from the study and reflection on the diverse sociological thinking.

Design a system to identify the most relevant traits of the historical development in micro and macro environments.

Construct: social analysis processes with more elements than the ones currently employed, in a way that allows them to participate in the social planning processes.

Elaborate an essay recognizing specific times and spaces, mainly identifying the role of human beings in history.

Construct serious and profound critique of their context, freely establishing their priorities as individuals and as part of a society, always considering the common well-being.

Operate in the la realization of their profession a more intimate closeness with society.

Elaborate a first draft that demonstrates the importance of historical knowledge to their role as social subjects. **Apply** a strategy that allows them to know and understand the difference and similarity of diverse cultures, so they can perform positively in any part of the world. **Elaborate** an intervention project in the community that will be defined by the instructor.	
Contents: **Unit 1 Society, Humanism and School.** 1.1 Exploration of the concept of society. 1.1.1 Basis that make it tangible. 1.1.2 Spatiality and temporality of the concept 1.1.3 Basic categories for its analysis 1.1.4 Human being in society 1.2 Humanism, Society, School. 1.2.1 Concept of humanism 1.2.2 Role of individual's formation and humanism. 1.2.3 Humanized society Vs. Dehumanized society 1.2.4 Socially accepted values and humanism 1.2.5 Humanism and university **1.3** Cases and application problems.	**Hours** **14**
Unit 2 Human Beings and History 2,1 History, what for? 2.2 Immediate history and the 90's. 2.3 40's and 50's and postwar. 2.4 The convulsions of the early 20th Century. 2.5 19th Century. Life and Development 2.6 From modernism to contemporaneity 2.7 Cases and application problems	 **14**
Unit 3 Contemporary paradigms: visions of today's actors. 3.1 Today's actors 3.1.1 Alvin Toffler and its change theory. 3.1.2 Carlos Fuentes and the internationalization of cultures for an including progress. 3.1.3 Erich Fromm: Where are we? Where are we going? 3.1.4 Perry Anderson and his vision of post Marxism. 3.1.5 Paulo Freyre his vision of Latin-American thinking. 3.1.6 Francis Fukuyama and trust as a central value 3.2 Daily routine crisis. 3.2.1 Great problems vs. notorious good choices 3.2.2 Basic forms of reality's knowledge 3.2.3 Role of time velocities 3.2.4 Company's social role	 **14**

3.2.5 Education as society's key element. 3.3 Study of cases and applications **Unit 4 Contemporary society as a trampoline to a future society.** 4.1 Regional social manifestations 4.2 The role of hope in human's dreams. 4.3 The social responsibility of man and youth. 4.4 Social values that should remain 4.5 Intervention projects with the aim of a fairer society. 4.6 Study of cases and applications	**14**
Unit 5 Social intervention projects in the community. 5.1 Definition and justification of the project 5.2 Project planning. 5.3 Project implementation. 5.4 Project assessment.	**8**

Learning activities:

Learning experiences in this course will be of an individual and group character. Some of them will be in the classroom with the instruction and other will be independent to be carried out by students out of the classroom. Those performed by students will be in the form of:

1. Collaborative work in the classroom to analyze and debate on the contents under the instructor's supervision

2. Method of cases to apply and assess the reach and limitations of the course contents

3. Cooperative work out of the classroom for the analysis of cases and solution of problems

4. Learning based on structure and non-structured problems so students can formulate problems and apply the course contents in the generation of solutions, either from individual efforts or as a result of teamwork starting from brainstorming

5. Presentation of contents by instructor, avoiding at all cost its becoming a costume throughout the course.

6. Learning based on application projects by teams so students can apply their knowledge on projects.

Assessment procedures and criteria:

Students performance through the course will be based on the following criteria

1. The manifested willingness and cooperation with concrete actions to achieve the learning objectives of each unit of the course's general objective.
2. The manifested commitment, honesty, seriousness, responsibility, quality, participation and creativity when executing all learning activities developed throughout the course.
3. The manifested ability and dexterity to solve the specific problems throughout the course.

Students performance through the course will be based on the following criteria:

Form	**Instrument**	**Percentage**
Interrogation and problem solving	Individual and group assignments in the form of questionnaires, essays, summaries, structured problems to solve, and bibliographical or internet research.	35%
Problem solving	Individual objective tests: Partial and final exam.	45%
Product request	Application, documental or field research and individual or group report of the project.	20%

Bibliography:

	Type	**Title**	**Author**	**Publisher**	**Year**
1	Reference	Esbozo de Historia de México	Juan Brom	Grijalva	1996
2	Reference	Esbozo de Historia Universal	Juan Brom	Grijalva	1990
3	Reference	Valores en la Educación	Pedro Ortega, Ramón Mínguez	Ariel	2001
4	Reference	Historia Mínima de México	Daniel Cossío Villegas	El Colegio de México	1994
5	Reference	Anatomía del Mexicano	Roger Bartra	Plaza Janés	2002

Syllabus

Subject: Mechanical Experimental Analysis	Code: MC412

Curricular location: eighth semester.

Course description

This course regards with mechanical systems theory, advanced servomechanisms, complex systems in three dimensions and mechanical circuit elements. State Space analysis and linear systems theory and feedback control systems are also considered.

General Learning Outcomes.

Students will know and practice the planning, design, construction and testing of common practice feedback and control systems in three dimensions.

Students will analyze mechanical circuits using different techniques, and also will synthesize mechanical control and feedback systems.

Contents:	**Hours**
1. Linear systems 1.1 Nature 1.2 Electrical analogies. 1.3 Primal and dual circuits. 1.4 Mechanical vibrations. 1.5 Modes of vibration. 1.6 Matrix analysis. 1.7 Control actions. 1.8 Transfer functions.	**18 (CLASS)** **10 (LAB)**
2. Feedback 2.1 Basic definitions. 2.2 Operational calculus. 2.3 Control actions that imply feedback. 2.4 Space State Analysis. 2.5 Equivalent systems. 2.6 Power calculations.	**14 (CLASS)** **6 (LAB)**

3. Advanced Mechanics of Materials. 3.1 Fracture 3.2 Plasticity 3.3 Hardness. 3.4 Vibration response. 3.5 Thermal effects. 3.6 Other associate effects.	**14 (CLASS)** **6 (LAB)**
4. Terminal project 4.1 State the problem 4.2 Investigate feasible solutions 4.3 Apply technology 4.4 Test prototype 4.5 General conclusion 4.6 Evaluation	**18 (CLASS)** **10 (LAB)**

Learning activities: All the activities are individual or by team (general group activities or integrating subgroups). They are classified in activities inside classroom (ICA) or outside classroom (OCA) ones. All ICA's are directed by the corresponding professor or expositor (if it could be convenient). Every OCA would be finished in a completely independent form, but under the proper supervision of Faculty. For every subject the learning activities could be at least the following (or others, similar or higher in pedagogical characteristics):

1. Case Analysis to state clearly the accomplishments of the course, properly linked to the real state of contemporary engineering.
2. Cooperative sessions to analyze and solve problems. When could be convenient laboratory sessions are mandatory, of course in presence of Faculty.
3. Learning based on structures and non structured problems. The goal is that students must state, solve and discuss proposals of solutions. They must evidence research and effective communications skills, in full accordance to Institutional Learning Outcomes.
4. Plenary discussions directed by students themselves and also directed by professor. Take care that this is not the only pedagogical strategy to be adopted.
5. Project oriented learning, focused on local requirements of Engineering Science.
6. Visits to companies, in order to gather important information about state of art of the subject. When this strategy could not be pertinent, it can be substituted by conference or Case Analysis.

Assessment:
The student's learning is to be measured under the following criteria:

1. Cooperative attitude, expressed by concrete and measurable actions that will be a clear evidence of the accomplishment of learning outcomes.
2. Engagement, honesty, seriousness, responsibility, attitude of participation and creativity expressed in the furtherance of learning outcomes.
3. Ability and dexterousness expressed in problem solving.
4. Fulfillment of proposed rubrics.
5. Reasonable attendance to class (when required 100% with no failure).

Form	**Instrument**	Percentage
Problem solving	Home works, questionnaires, essays, summaries, documental and data base researches.	35%
Objective tests	At a mid term and a final written exam.	45%
Diverse products	Class project by teams, e-portfolios. Evidence generation, according the nature of subject.	20%
	TOTAL	**100%**

Bibliography

No.	**Type**	**Title**	**Author**	**Editorial**
1	Text	Design of Machine Elements	M.F. Spots	Prentice Hall
2	Reference	Diseño de elementos mecánicos	Robert L. Mott	Prentice Hall
3	Reference	Diseño en Ingeniería Mecánica	Joseph Shigley	Mc Graw Hill

Syllabus

Subject: PLANT ENGINEERING	Code: MC413

Curricular location: eighth semester.

Description of the course.

This is a terminal course. Students will have several experiences in industry which ensures the correct interpretation of actual trends in Mechanical Engineering.

General Learning Outcomes.

Students are required to:

Understand the usual and practical energy administration in plant.

Know and understand the better practices in air pollution control.

Know and understand the optimal energy resources available in Baja California and the United States.

Apply engineering regulations to evaluate the industrial reality.

Contents:	Hours
1. Layout and project of Power Plant Layouts of Steam cycles. Diesel operated plants Gas turbine powered plants Power cycles	15
2. Steam Boiler and Cycles High pressure and supercritical boilers Analysis of power plant cycles and reversibility, availability Waste heat recovery, Other boilers.	13
3. Fuel and Ash Handling, Combustion Chamber, Draught, Air Pollution Preparation and handling of fuels Dust collectors Ash removal Stokers Pulverised fuel burning Cooling towers Analysis of pollution from thermal power plants Pollution controls	13
4. Automatic controls Feedwater Steam Fuel Air supply and combustion Boiler testing and trails Inspection and safety regulations Economics	13
5. Pneumatic conveying Selection of blowers Dense and dilute phases	10

Learning activities: All the activities are individual or by team (general group activities or integrating subgroups). They are classified in activities inside classroom (ICA) or outside classroom (OCA) ones. All ICA's are directed by the corresponding professor or expositor (if it could be convenient). Every OCA would be finished in a completely independent form, but under the proper supervision of Faculty. For every subject the learning activities could be at least the following (or others, similar or higher in pedagogical characteristics):

1. Case Analysis to state clearly the accomplishments of the course, properly linked to the real state of contemporary engineering.
2. Cooperative sessions to analyze and solve problems. When could be convenient laboratory sessions are mandatory, of course in presence of Faculty.
3. Learning based on structures and non structured problems. The goal is that students must state, solve and discuss proposals of solutions. They must evidence research and effective communications skills, in full accordance to Institutional Learning Outcomes.
4. Plenary discussions directed by students themselves and also directed by professor. Take care that this is not the only pedagogical strategy to be adopted.
5. Project oriented learning, focused on local requirements of Engineering Science.
6. Visits to companies, in order to gather important information about state of art of the subject. When this strategy could not be pertinent, it can be substituted by conference or Case Analysis.

Assessment:
The student's learning is to be measured under the following criteria:

1. Cooperative attitude, expressed by concrete and measurable actions that will be a clear evidence of the accomplishment of learning outcomes.
2. Engagement, honesty, seriousness, responsibility, attitude of participation and creativity expressed in the furtherance of learning outcomes.
3. Ability and dexterousness expressed in problem solving.
4. Fulfillment of proposed rubrics.
5. Reasonable attendance to class (when required 100% with no failure).

Form	**Instrument**	Percentage
Problem solving	Home works, questionnaires, essays, summaries, documental and data base researches.	35%
Objective tests	At a mid term and a final written exam.	45%
Diverse products	Class project by teams, e-portfolios. Evidence generation, according the nature of subject.	20%
	TOTAL	**100%**

Bibliography

No.	Type	Title	Author	Editorial
1	Text	Power Plant Engineering	G.R. Nagpal	Hanna Publishers, 1998.
2	Reference	Power Plant Engineering	K.K.Ramalingam	Scitech Publications, 2002.
3	Reference	Introduction to Power Plant Technology	G.D.Rai	Khanna Publishers, 1995

Syllabus

Subject: HEAT TRANSFER	Code: **MC414**

Curricular location: eighth semester.

Course description.

Topics will include one, two and three dimensional analysis of the governing equations for neat transmission including solutions by analytical and numerical techniques.

Equations for convection (forced and natural) with applications are going to be fully developed in duct flow, parallel flow, and change of phase heat transfer.

Radiation will be considered between surfaces, directional and spectral characteristics of surfaces.

Furnaces are studied also.

General learning outcomes:

At the end of the course students are expected to:

Define system and surroundings, thermal equilibrium, the quantitative formulation of heat transfer problems.

Solve and discuss conditions of heat transmission in steady state.

Solve Fourier equation with most important boundary conditions.

Apply dimensional analysis to state particular description numbers (Nussel, Prandatl).

State, solve and verify in laboratory several heat transmission modes in engineering systems.

Contents:	Hours
1. Introduction. 1.1. System characterization. 1.2. Boundaries and surroundings. 1.3. Rate variations associated with heat transfer. 1.4. Differential description.	**8**
2. One dimensional problem. 2.1. Fourier Law and solutions. 2.2. Applications.	**8**
3. Two and three dimensional flow. 3.1. Generalization of the problem. 3.2. Systems of coordinates. 3.3. Software solutions.	**8**
4. Superposition principle. 4.1. Transfer of heat in fluids. 4.2. General conservation laws. 4.3. Duhamel's Law.	**8**
5. Other modes of Heat Transfer. 5.1. Radiation. 5.2. Convection. 5.3. Combined forms.	**18**
6. Dimensional Analysis. 6.1. Formulation of the problem. 6.2. Special numbers in Fluid Dynamics and Heat Transfer. 6.3. Graphical Analysis.	**14**

Learning activities: All the activities are individual or by team (general group activities or integrating subgroups). They are classified in activities inside classroom (ICA) or outside classroom (OCA) ones. All ICA's are directed by the corresponding professor or expositor (if it could be convenient). Every OCA would be finished in a completely independent form, but under the proper supervision of Faculty. For every subject the learning activities could be at least the following (or others, similar or higher in pedagogical characteristics):

13. Case Analysis to state clearly the accomplishments of the course, properly linked to the real state of contemporary engineering.
14. Cooperative sessions to analyze and solve problems. When could be convenient laboratory sessions are mandatory, of course in presence of

Faculty.

15. Learning based on structures and non structured problems. The goal is that students must state, solve and discuss proposals of solutions. They must evidence research and effective communications skills, in full accordance to Institutional Learning Outcomes.
16. Plenary discussions directed by students themselves and also directed by professor. Take care that this is not the only pedagogical strategy to be adopted.
17. Project oriented learning, focused on local requirements of Engineering Science.
18. Visits to companies, in order to gather important information about state of art of the subject. When this strategy could not be pertinent, it can be substituted by conference or Case Analysis.

Assessment:
The student's learning is to be measured under the following criteria:

11. Cooperative attitude, expressed by concrete and measurable actions that will be a clear evidence of the accomplishment of learning outcomes.
12. Engagement, honesty, seriousness, responsibility, attitude of participation and creativity expressed in the furtherance of learning outcomes.
13. Ability and dexterousness expressed in problem solving.
14. Fulfillment of proposed rubrics.
15. Reasonable attendance to class (when required 100% with no failure).

Form	**Instrument**	Percentage
Problem solving	Home works, questionnaires, essays, summaries, documental and data base researches.	35%
Objective tests	At a mid term and a final written exam.	45%
Diverse products	Class project by teams, e-portfolios. Evidence generation, according the nature of subject.	20%
	TOTAL	**100%**

Bibliography

	Type	Title	Author	Editorial	Year
1	Text	Heat Transfer	Mills, A. F.	Prentice Hall	2001
2	Reference	Conduction of Heat in Solids	Carslaw, H. S. and J. C. Jaeger	Oxford University Press	1995
3	Reference	Numerical Heat Transfer and Fluid Flow	Patankar, Suhas V.	Hemisphere Publishing Corporation, 1980.	1980

CETYS UNIVERSIDAD

Course Program

Course Name	**Course ID**
Human Being and Ethics	HU 402

Placement in curricular map:

This course is located in seventh or eighth semester of all of CETYS University's majors; it is not serialized with other courses but is recommended to be the last course to be taken as part of their general training.

Course Characteristics:

Human Being and Ethics is third in a series of three courses that CETYS has implanted in its three campi for students of all bachelor degrees. These courses seek to imprint a distinctive characteristic in all CETYS students, through reflecting on Human Beings and the way they relate with their environment, their past, their society, and themselves.

This course reflects on some anthropological conceptions in order to later establish the fundamental criteria for a better ethical discernment from a human being centered point of view. It takes on the field of personal and social values, which are taken on in some margins of liberty. It culminates with the recognition of the responsibilities in the workplace to establish some reflection on professional ethics.

Students are required to have the ability of reading comprehension as well as writing essays, and book reports, ability for oral communication in public, as well as the skill and tolerance to work in groups. At a knowledgeable level, it is recommended that the student have clear basic concepts of anthropological reflection done in the Human Beings, History, and Society course.

General Learning Objectives
At the end of this course, students will: • Elaborate an essay where different versions of Human Beings and Ethics will be discussed. • Create an organizational chart where the contents of the unit are integrated. • Present a written paper where a reflection upon his/her own values will be exposed. • Structure a code of ethics according to their profession.

Thematic content:

	Hours
Unit I: Relationship of humans and the world. 1.1. Some visions about Humans 1.2. The world of Humans 1.3. Problems to approaching ethics 1.4 Types of Ethics 1.5 Ethics and problems in Mexico 1.6 Ethics in CETYS' mission	16
Unit II: Human Liberty and Conscience 2.1. Humane acts and acts of humans 2.2. Amoralism 2.3. Liberty 2.4 Types of Liberty 2.5 Responsibility modifiers 2.6 Determinism 2.7 Evidence of liberty 2.8 Types of conscience 2.9 Formation of conscience	16
Unit III: Values 3.1. What is goodness? 3.2 Goodness as a value 3.3 What are values? 3.4 Axiological subjectivism and objectivism. 3.5 Synthetic position 3.6 Characteristics of values 3.7 Values and alumni characteristics	16
Unit IV: Professional Ethics and Social Responsibility. 4.1. Professional Ethics 4.2. Basic criteria on professional ethics.	16

4.3. Code of Ethics 4.4 Relations inside organizations. 4.5 Society-Organization relations 4.6 Social Responsibility	

Learning Activities:

Under Instructor supervision:
- Group discussions
- Group discussions
- Instructor presentations
- Collaborative work using diverse learning strategies.
- Student presentations
- Organizational graph elaboration.

Independent Activities:
- Conduct research
- Solve assignment exercises based on questions.
- Case solution
- Presentation preparation
- Recuperation in situations of moral court.
- Research information on-line.
- Solution of moral dilemmas
- Elaboration of their own code of ethics

Assessment criteria and procedures:

Each of the four units of this course will have a value of 25%

In each of them, accordingly, the following elements will be observed:
a) Individual work (book reports, research, final project)
b) Group work (presentations, organizational graph elaboration, discussions, case solving) de
c) Performance self-assessment
d) Co-assessment

Bibliography

	Type	Title	Author	Publisher	Year
1	Book	Ethics, theory and application	FAGOTHEY, Austin	McGraw-Hill	1994
2	Book	Ethics in Business, cases and applications	VELÁSQUEZ, Manuel G	Pearson Educación	2002
3	Book	Ethical dilemmas of modern corporations.	LLANO Cifuentes, Carlos	F.C.E.	1997