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**1. Course number and name**

80116 Differential calculus

**2. Credits and contact hours**

Credits: 3

Attendance hours: 5 per week

Autonomous work: 6 per week

**3. Text book, title, author, and year**

- Stewart James. Calculus of a variable, early transcendental. Cengage Learning México. 2012
- Thomas George. Calculus of a variable. Pearson Education. Mexico .2010.
- Piskunov Nikolai. Differential and Integral Calculus. Noriega Publishers Group. México.1993.
  
- a. other supplemental materials
- Haeussler Ernest. Math for administration and economics. Pearson Prentice Hall. México .2008.
- Purcell Edwin. Differential and Integral Calculus. Pearson Education. México .2007.

**4. Specific course information**

- a. brief description of the content of the course (catalog description).  
The purpose of this course is give students the knowledge and fundamental concepts of single variable and several skills allowing them to work with the concepts.
- b. prerequisites or co-requisites. None.
- c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required.

**5. Specific goals for the course**

- a. This course requires previous knowledge of algebra and trigonometry of high school. Upon completion of this course, students will be able to:
  - Draw functions of single variable to determine domain, range, asymptotes, growth and/or decay intervals and concavity.
  - Apply the concepts of average rate, instantaneous average, related rate and optimization to specific problems and other contexts.
- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
  - (a) an ability to apply knowledge of mathematics, science, and engineering

## 6. Brief list of topics to be covered

- Four Ways to represent a Function
- Mathematical Models: A catalog of Essential Functions
- New Functions from old Functions
- Graphing Calculators and Computers
- Exponential Functions
- Inverse Functions and Logarithms
- The Tangent and Velocity Problems
- The Limit of a function
- Calculating Limits Using the Limit Laws
- The precise Definition of a Limit
- Continuity
- Limits at Infinity; Horizontal Asymptotes
- Tangents, Velocities, and other Rates of Change
- Derivatives
- The Derivative as a Function
- Derivatives of polynomials and Exponential Functions
- The Product and Quotient Rules
- Rates of Change in the Natural and Social Sciences
- Derivatives of trigonometric Functions
- The Chain Rule
- Implicit Differentiation
- Higher Derivatives
- Derivatives of Logarithmic Functions
- Hyperbolic Functions
- Related Rates
- Linear approximations and Differentials.
- Maximum and Minimum Values
- The Mean Value Theorem
- How Derivatives Affect the Shape of a Graph
- Indeterminate Forms and L'Hospital's Rule
- Summary Of Curve Sketching
- Optimization Problems

**1. Course number and name**

700020 Basic Idiomatic Skills

**2. Credits and contact hours**

Credits: 2

Attendance hours: 3 per week

Autonomous work: 6 per week

**3. Text book, title, author, and year**

- Creme Phyllis y Mary, Lea R. Escribir en la universidad. Barcelona. Gedisa. 2000.
- G. de Montes, Zoraida y Montes, Laura. Mapas mentales paso a paso. México: Alfaomega, 2003.
- Instituto Cervantes. Saber escribir. Bogotá: Aguilar, 2007.
- Martín Vivaldi, Gonzalo. Curso de redacción: teoría y práctica de la composición y del estilo. Madrid: Paraninfo, 2000.
- Nueva gramática de la lengua española. Manual. Bogotá: Espasa, 2010.
- Ortografía básica de la lengua española. Bogotá: Real Academia Española-Espasa, 2012.
- Perelman, Chaïm y Olbrechts-Tyteca, Lucille. Tratado de la argumentación. La Nueva Retórica. Madrid: Gredos, 1989.
- Robinson, Ken y Lou Aronica. El elemento. Madrid: DeBolsillo, 2011.

**4. Specific course information**

- a. brief description of the content of the course (catalog description).  
The purpose of this course is train students in the knowledge of the native language as a basic tool to develop reading, writing and oral skills that will help strengthen their critical thinking.
- b. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required.

**5. Specific goals for the course**

- a. Upon completion of this course, students will be able to:
  - Identify university reading as a cognitive process, develops planning strategies for academic writing and also, plans and elaborates oral speeches.
  - Reinforce grammar and spelling of the Spanish language.
  - Improve the ability to navigate and consult in the electronic media.
  - Incorporate skills in the handling of computer tools applied to the reading and writing processes.
  - Perform academic activities agreed with the teacher for the development of basic language skills.

- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
- (g) An ability to communicate effectively.

**6. Brief list of topics to be covered**

- Reading as a form of access to knowledge.
- Aesthetic reading.
- Reader process.
- Inferential reading and critical reading.
- Reading workshops and practical application of the reading process
- Inferential reading workshop
- Critical reading workshop
- The grammar of the Castilian language: morphology and syntax.
- Organization and textual creation
- Planning. Elaboration of the draft.
- Review and edit. Punctuation, use and application signs.
- Argumentative writing workshops.
- Elaboration of an argumentative text. Critical elucidation of the argumentative text.
- Active listening
- The dialogue
- The pragmatics of dialogue
- Oral presentation
- Workshops of critical listening of academic discourse
- Workshops of academic speech. Guidance and oral support of academic discourse.

**1. Course number and name**

21104 Introduction to CAD

**2. Credits and contact hours**

Credits: 3

Working hours: 3

Individual work hours: 3

**3. Text book, title, author, and year**

- Schaum's Outlines Descriptive Geometry; Hawk, M. C.; Mc Graw Hill; New York; 1962.
- Geometría Descriptiva; Wellman, B. L.; Editorial Reverte S. A.; Barcelona; 1987.
- Aprender AutoCAD 2015 con 100 ejercicios prácticos; Alfa Omega; Barcelona; 2015.
- AutoCAD 2002 Avanzado; Tajadura Zapirain, J.A. y Lopez Fernandez, J.; Mc Graw Hill; Madrid; 2002.
- Inventor y su simulación con ejercicios prácticos; Younis, W.; AlfaOmega; México; 2013.

a. other supplemental materials

- Web page Virtual sabana:  
<http://virtual.unisabana.edu.co/course/view.php?id=9390>
- Blog : <https://introduccionalcad.blogspot.com.co/>

**4. Specific course information**

a. brief description of the content of the course (catalog description).

The purpose of these course is give the students concepts and technological tools for them to be able to make a graphical representation. Which is a very important issue in the communication between engineers.

b. prerequisites or co-requisites. None

c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required

**5. Specific goals for the course**

a. Specific outcomes of instruction:

- The student will be able to understand and manage the graphical representations in two and three dimensions.
  - The students will have the ability to develop their engineering careers with the use of specialized software in order for them to create any type of representations.
  - The students will be able to interpret graphical representations in different scales.
- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.



(k). An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

**6. Brief list of topics to be covered**

- Introduction (to geometry and descriptive geometry)
- Projection of a point
- Projection of a line
- Projection of a plane
- Course, slope, real magnitude
- Intersections (line-plane, plane-plane)
- Special projections
- Rotations
- Geometric bodies
- Introduction (GUI, keyboard manage, among others)
- Object construction (Commands, coordinates, types of lines)
- Edition and organization (modifications, colors, layers)
- Bounded and dimensions.
- 3D Representations
- Creation of projects
- Pieces module
- Assembly module
- Presentation module
- Blueprints module
- Render module
- Animation module

**1. Course number and name**

80062 Introduction to Engineering

**2. Credits and contact hours**

Credits: 2

Attendance hours: 2 per week

Autonomous work: 4 per week

**3. Text book, title, author, and year**

- Thinking like an Engineer: An Active Learning Approach by E. A. Stephan, D. R. Bowman, W. J. Park, B. L. Sill, and M. W. Ohland (Prentice Hall, 2011 /ISBN-13: 978-0-13-606442-8
  - a. other supplemental materials
- Supplementary course material is available at Virtual Sabana -Online system (<http://virtual.unisabana.edu.co/course/view>) for students registered for the course

**4. Specific course information**

- a. brief description of the content of the course (catalog description).  
This course introduces the engineering profession. Information on the different disciplines of engineering will be presented. Professional and ethical aspects of engineering are covered. An introduction to problem solving and the engineering design process.
- b. prerequisites or co-requisites. None
- c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required.

**5. Specific goals for the course**

- a. Specific outcomes of instruction.
  - To prepare students for the rigor of future engineering classes
  - To provide students with a solid foundation of basic engineering skills
  - To introduce students to the different engineering majors and career options
- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
  - (d) An ability to function on multidisciplinary teams.
  - (c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
  - (e) An ability to identify, formulate, and solve engineering problems.

**6. Brief list of topics to be covered**

- Identify future career paths and job opportunities as related to the Engineering profession.

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- How might we create the best possible solution to a problem?
- What is the most effective way to generate potential solutions to a problem?
- How many alternate solutions should you generate?
- What are the most pressing engineering/technical problems of our time?
- What is an engineer? What types of work do engineers do?
- List some of the basic tenets of the Codes of Engineering Ethics.
- Discuss case studies as applied to Engineering.

**1. Course number and name**

81107 Introduction to Colombian Economy

**2. Credits and contact hours**

Credits: 3

Attendance hours: 3

Autonomous work: 6

**3. Text book, title, author, and year**

- Cárdenas, M. (2013). Introduction to the Colombian Economy. Alfaomega. Edition 3.
- Mankiw, G (2002). Principles of Economics. McGraw Hill. Edition 2.
  - a. other supplemental materials
- Álvarez. O., & Sánchez. F. (2011). "Informality at work and labor costs in Colombia 1984-2009". In Documents CEDE, University of the Andes.
- Bernal. R., & Camacho. A., & Flórez. C., & Gaviria. A., & Jaramillo. C., & Nupia. O., & Peña. X., & Rodríguez. C., & Sánchez. F., & Urrutia. M. (2009). "Economic development: challenges and public policies". In Documents CEDE, University of the Andes.

**4. Specific course information**

- a. brief description of the content of the course (catalog description).

The purpose of this course is introducing the student in the main concepts and techniques used in Economics. The application of theory and the use of tools will be implemented on the Colombian context.

- b. Prerequisites or co-requisites: None.

- c. Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required.

**5. Specific goals for the course**

- a. Specific outcomes of instruction.

- Define the main economic variables and describe their behavior considering economic news.
- Understand the main concepts of economics and relate them in general to the behavior of the Colombian economy.
- To express in oral and written form analysis and argumentative criticism against the behavior of the economy of the country considering the main concepts and economic variables.

- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

(j) A knowledge of contemporary issues

**6. Brief list of topics to be covered**

- Introduction
- Aggregated Offer

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- PIB
- Growing economic
- Economy and history
- Exportation and trade polities
- Aggregated Demand

**1. Course number and name**

21106 Introduction to Computer Programming.

**2. Credits and contact hours**

Credits: 3

Attendance hours: 4

Autonomous work: 5

**3. Text book, title, author, and year**

- No guide book is followed
- a. other supplemental materials
  - Fundamentos de programación, aprendizaje activo basado en casos. Villalobos y Casallas. Pearson Editores.
  - Programación en Java 7. Luis Joyanes. McGraw Hill editores.
  - Java how to program by Deitel & Deitel. Prentice Hall editors.
  - Head First Object-Oriented Analysis and Design by Brett D. McLaughlin. O'Reilly editors.

**4. Specific course information**

- a. brief description of the content of the course (catalog description).

This course aims to develop the basic skills inherent to learning and applying the logic of programming. The essential theme is the recognition of the basic logic structures of programming around the concepts of sequentially, conditionality, repeatability or cyclic task and some basic data structures.
- b. prerequisites or co-requisites: None
- c. indicate whether a required: elective, or selected elective (as per Table 5-1)  
course in the program: Required

**5. Specific goals for the course**

- a. Specific outcomes of instruction, ex.
  - Develop capacities for algorithmic reasoning and for the development of basic programs in an object-oriented language.
  - Identify, formulate and solve engineering problems that require programming of computational devices.
  - They will be competent in perform the analysis and design of computer programs of basic complexity.
- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
  - (e) an ability to identify, formulate, and solve engineering problems
  - (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

**6. Brief list of topics to be covered**

- The concept of process
- Sequentially
- Simple conditionality
- Nested conditionality
- Variables in Java
- Input and output in Java
- Conversion of data type in Java
- Mathematical, relational and logical operations in Java
- The Math classes
- The String classes
- Programming logical structures in Java
- Static arrangements one dimension
- Static arrangement two dimensions

**1. Course number and name:**

21102 General Chemistry I

**2. Credits and contact hours:**

Credits: 3

Contact hours: 5

Individual work hours: 4

**3. Text book, title, author, and year**

- BROWN, T., LeMAYT, H.E. y BURSTEN, B., 2004, Chemistry, The Central Science, 9<sup>a</sup> Ed., Ed. Prentice Hall, México.
- CHANG, R., 2007, Chemistry, 9<sup>a</sup> Ed., Ed. Mac Graw Hill, China.

**a. Other supplemental materials**

- WHITTEN, K., DAVIS, R. y PECK, M., 2008, General Chemistry, 8<sup>a</sup> Ed., Ed. Mac Graw Hill, Madrid.
- KOTZ, J.C. y TREICHEL, P.M., 2005, Chemistry and Chemical Reactivity, 6<sup>a</sup> Edition, Ed. Thomson, México.
- PETRUCCI, R. y HARWOOD, W., 1999, General Chemistry, 7<sup>a</sup> Ed., Ed. Prentice may Iberia, Madrid.
- BRICEÑO, C.O. y RODRIGUEZ DE CACERES, L., 1999, Chemistry, 2<sup>a</sup> Ed., Fondo Educativo Panamericano, Bogotá.
- EBBING, D.D. y GAMMON S.D. 2010, General Chemistry, 9<sup>a</sup> Ed., Cengage Learning, México.

**4. Specific course information**

a. brief description of the content of the course

One of the professional strengths of an engineer is the panoramic view that allows him to observe the different factors related to a situation and analyze them critically to make adequate and well-argued proposals. The basic scientific basis allows the professional to understand the natural environment and brings it closer to scientific and technological development. This subject provides the basis for understanding the physical behavior of materials; knowing the atomic and molecular structure of matter can understand the interactions between different particles that cause the different states of aggregation of substances and the possibility of mixing with each other.

b. prerequisites or co-requisites: None

c. Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required



## **5. Specific goals for the course**

### a. Specific outcomes of instruction

The student will be able to:

- Awaken curiosity and intellectual restlessness for everything that surrounds us.
  - Develop reading and writing skills (in text, tables and graphs) in the context of this science.
  - Know the basic physical principles that explain the behavior of materials and allow understanding the environment.
  - Develop ability to relate variables.
  - Apply, in the topics covered in the program, the mathematical concept of proportions, developing skills for its management.
  - Encourage students to develop an abstract thinking, with the ability to relate it to concrete thinking.
  - Recognize the dynamism of science and technology, understanding the important role of research in its development.
  - Promote the development of a logical and critical thinking in the analysis and interpretation of problematic situations and in the proposal of solutions to them with good arguments.
  - Create habits that help take responsibility for the study.
- b. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
- (a) Applies knowledge of science, mathematics and engineering

## **6. Brief list of topics to be covered**

- Measurements, International System of Units and precision and accuracy of measurements
- Fundamental concepts on matter and energy
- Atomic and molecular structures
- Concept of mol
- Physical behavior of materials: intermolecular forces
- Changes in condition: solid, liquid and gaseous
- Homogeneous mixtures. Solutions and colloids

**1. Course number and name**

80114 Integral Calculus

**2. Credits and contact hours**

Credits: 3

Attendance hours: 4 per week

Autonomous work: 5 per week

**3. Text book, title, author, and year**

- J. STEWART calculus in a variable, Edition 7, Early Trascendentals (Vol 1) Cengage Learning. México. 2012
- R. Cano Integral Calculus, Second Edition. University of the Sabana. Colombia.2017.
- G. B. Thomas, R.L .FINNEY , M.D. WEIR Calculus with analytical Geometry. Addison – Wesley. 1999.
- a. other supplemental materials
  - Edwards, PENNEY Calculus with analytical Geometry. Addison –Wesley. 1999.
  - S.L SALAS, E. HILLE Calculus of one several Variables with analytical Geometry. Reverts 200.

**4. Specific course information**

- a. brief description of the content of the course (catalog description).

The purpose of this course is give students the knowledge for integration of functions of one variable, with applications. The course includes the representation of functions by Taylor in single variable.

- b. prerequisites or co-requisites. 21101 Differential calculus.
- c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required.

**5. Specific goals for the course**

- a. Specific outcomes of instruction, ex.

This course requires previous knowledge on differential calculus. Upon completion of this course, students will be able to:

- Calculate areas using Riemann's sums and/or the fundamental theorem of calculus.
- Apply the concept of integration to calculate areas between curves, curve length, volume of a revolution solid and applications.
- Determine the convergence value of a series or determine whether it is convergent or divergent.
- Apply function representation using Taylor series to approximate the calculation of defined integrals.

- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
- (a) An ability to apply knowledge of mathematics, science, and engineering

**6. Brief list of topics to be covered**

- Antiderivatives
- Notation
- Areas and estimation using finite sums
- Definite integral definition
- Fundamental Theorem of Calculus
- Indefinite integrals
- Method of substitution
- Integration by parts
- Trigonometric integrals
- Trigonometric substitution
- Partial fractions
- Improper integrals
- Area between curves
- Volumes and areas of revolution
- Volumes and areas of revolution
- Curve length
- Courses in economics
- Integral in physics and engineering
- Successions
- Series
- Criterion of integral
- Comparison criterion
- Criterion of reason and root  $n$ -ésima
- Alternating series
- Power series
- Taylor series

**1. Course number and name**

21202 Mechanical Physics

**2. Credits and contact hours**

Credits: 4

Attendance hours: 5 per week

Autonomous work: 7 per week

**3. Text book, title, author, and year**

- Halliday & Resnick, Fundamentals of physics, tenth edition, ISBN: 978-1-118-23072-5, Wiley, 2014
- Serway Raymond, Jewett John. Physics for scientists and engineer, Cengage Learning, 9 edition (2015).
- Sears, Semansky, University physics, 10th edition. Addison Wesley (2000).
- a. other supplemental materials
  - W. Bauer, G. D. Westfall, University physics with modern physics, 2 edition, Mc Graw Hill, (2013)

**4. Specific course information**

- a. brief description of the content of the course (catalog description).  
The purpose of this course is to introduce to the quantitative aspects of physical mechanics application of fundamental concepts in physics and mathematics. The course includes topics like vectors, Newtonian particle mechanics, energy, momentum, several conservation laws and the application of these contexts in the experimental laboratory.
- b. prerequisites or co-requisites. 21101 Differential calculus
- c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required.

**5. Specific goals for the course**

- a. Specific outcomes of instruction, ex.  
Students will be able to:
  - Interpret the results of measurements and experimental observations of two variables to approximate parameters, make predictions and compare with theoretical expectations.
  - Understand the meaning of the position, the velocity and the acceleration in translational and rotational motion and to establish relations between them for motions with uniform and non-uniform acceleration.
  - Identify any case of translational or rotational motion as the superposition of various one-dimensional movements and to establish relationships between the components of the different kinematic variables.
  - Determine the equations of translational and rotational motion for an object based on force diagrams, constant in time or not, and the initial conditions.
  - Solve problems involving translational and rotational motion.

- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
- (a) an ability to apply knowledge of mathematics, science, and engineering
  - (b) an ability to design and conduct experiments, as well as to analyze and interpret data.

**6. Brief list of topics to be covered**

- Changing units, Orders of magnitude and scales.
- Positioning, displacement and average velocity.
- Instantaneous velocity and speed, Acceleration.
- Free-fall.
- Vectors
- Projectile motion, Circular motion.
- Relative movement in two and three dimensions.
- Friction, Drag force and terminal speed.
- Working examples: gravitational force, electric force, variable force.
- Power.
- Potential energy, Conservation of mechanical energy.
- Interpretation of potential energy curves.
- Work done on a system by an external force.
- Conservation of energy.
- Conservation of momentum, Collisions and impulse.
- The center of mass.
- Angular velocity and acceleration.
- Rotation with uniform angular acceleration.
- Relationship between linear and rotational variables.
- Energy in the rotational movement.
- Moment of inertia and theorem of the parallel axes.
- Torque
- Newton's second law for rotational motion.
- Rotational kinetic, work and energy.
- Rolling and Angular momentum

**1. Course number and name**

80101 Linear Algebra

**2. Credits and contact hours**

Credits: 3

Attendance hours: 4 per week

Autonomous work: 5 per week

**3. Text book, title, author, and year**

- Grossman, Stanley. Linear Algebra. Sixth Edition. Mc Graw Hill. Mexico, 2008.
- Kolman, Bernard. Linear Algebra with matlab applications. Pearson Education of Colombia, 1999.
- Lang Serge. Linear Algebra .Third Edition .Springer .New York .1987.
- a. other supplemental materials
- Strang, Gilbert .Introduction to linear Algebra .Fifth Edition .Wellesley Cambridge Press. United States.2016.

**4. Specific course information**

- a. brief description of the content of the course (catalog description).

The purpose of this course is give students the knowledge of matrix theory, linear algebra, systems of linear equations and the properties of matrices.

- b. prerequisites or co-requisites. Not required.
- c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required.

**5. Specific goals for the course**

- a. Specific outcomes of instruction, ex.

This course requires previous knowledge of algebra and trigonometry of high school. Upon completion of this course, students will be able to:

- Solve problems using systems of linear equations.
- Calculate equations of lines, planes, areas of parallelograms and volumes of parallelepipeds by relating them to vectors in two and three dimensions.
- Use the matrix representation of a linear transformation associating concepts such as rank, nullity and dimension.
- Apply the concepts of eigenvalue and eigenvector to obtain the diagonal representation of a matrix.

- a. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

(a). an ability to apply knowledge of mathematics, science, and engineering

**6. Brief list of topics to be covered**

- Matrices
- Matrix operations

- Matrices and systems of linear equations.
- Elimination of Gauss-Jordan
- Inverse of a square matrix.
- Matrix transposed
- Definitions
- Properties of the determinant.
- Inverse of a square matrix.
- Matrix transposed
- Scalar product and projections
- Cross product.
- Equation of lines and planes in  $R^3$
- Definition and basic properties.
- Vector subspaces.
- Linear combination and generated space.
- Linear independence.
- Bases and dimension.
- Range and nullity
- Definition and examples.
- Matrix representation.
- Eigenvalues and eigenvectors associated with a matrix.
- Similar matrices and diagonalization.

**1. Course number and name**

120015 Basic Digital Skills

**2. Credits and contact hours**

Credits: 3

Attendance hours: 3 per week

Autonomous work: 6 per week

**3. Text book, title, author, and year**

- Brillo: así es el sistema operativo de Google para el Internet de las cosas (2015). Recuperado de <http://www.xataka.com/internet-of-things/brillo-asi-es-el-sistema-operativo-de-google-para-el-internet-de-las-cosas>
- Intel. (2014). Internet of Things Video: IoT Explained. Recuperado de <http://www.intel.es/content/www/es/es/internet-of-things/videos/what-is-the-internet-of-things.html>
- Universidad de Deusto. (2011). Internet de las Cosas. Recuperado de <https://www.youtube.com/watch?v=542oTWpKPIE>
- Ministerio de las TIC. (s.f). Ciudades inteligentes. Recuperado de <http://estrategiaticolombia.co/ciudadesinteligentes/#competitividad---convivencia> o <http://www.eduteka.org/modulos/1/8/2118/1>
- History Chanel. (2014). Robótica, Documental. Recuperado de [https://www.youtube.com/watch?v=3ZjpMg\\_UzIQ](https://www.youtube.com/watch?v=3ZjpMg_UzIQ)
- Eduteka. (2014). Bitácora de evaluación. <http://www.eduteka.org/glosario/tiki-index.php?page=Bit%C3%A1cora+de+evaluaci%C3%B3n>

a. other supplemental materials

- Cárdenas, M. (2014). Video 1 - Competencias en manejo de información – Mahara. <https://www.youtube.com/watch?v=UPIF6qkXr08>
- Cárdenas, M. (2014). Video 2 - Competencias en manejo de información – Mahara. <https://www.youtube.com/watch?v=UPIF6qkXr08>

**4. Specific course information**

- a. brief description of the content of the course (catalog description).  
The purpose of this course is give students the knowledge and fundamental concepts that are part of the digital competition proposed by the University.
- b. prerequisites or co-requisites. None.
- c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required.

**5. Specific goals for the course**

- a. Upon completion of this course, students will be able to:
  - Explains the different elements of knowledge products.
  - Reuses knowledge products and generates new uses and representations.



- Designs, plans and evaluates collaborative work strategies that allow him / her to meet the proposed objectives.
- Recognizes when and how to use technology of information and communication in academic settings.
- Promotes and practices the intellectual property statute guidelines.
- Develops an intuitive use of computer tools, and adapts easily to the changes that occur in them.
- Choose the most appropriate technological tools to fulfill the proposed objectives.
  - a. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
  - (g) An ability to communicate effectively.

**6. Brief list of topics to be covered**

- Type of Societies through mental maps.
- Introduction to the current Trends in technology of information and communication.
- Formulation of good quality questions to guide the search of information.
- Use of databases.
- Planning of projects mediated by technology of information and communication.
- Application of criteria for evaluation of information.
- APA reference standards.
- Copyright (CR, CL, CC).
- Fundamentals of Multimedia, fundamentals of design, color theory and typography.
- Reality and Virtual Reality

**1. Course number and name:**

62133 English Level 3

**2. Credits and contact hours:**

Credits: 3

Contact hours: 4

Individual work hours: 4

**3. Text book, title, author, and year**

- Atwell, N. (2002). Lessons that change writers. United States: Heinemann.
- Barker, H, Cunningham, S & Moor, P. (2008). New Cutting-Edge Pre-intermediate. (5th ed.). China: Pearson Education Limited.
- Clare, A & Wilson, J. (2013). Speakout Pre-intermediate. (7th ed.). Slovakia: Pearson Education Limited.
- Davis, R. (1998 - 2015). Esl-labcom. Retrieved August, 2015, from <http://www.esl-lab.com/>
- McGraw-Hill, (Ed). (2010). Writer's Choice. (1st ed.). Columbus: McGraw-Hill.
- Soars, J & Soars, L. (2004). New Headway Pre-intermediate. (4th ed.). England: Oxford University Press.

**4. Specific course information**

Brief description of the content of the course (catalog description)

- a. Students will read and show understanding of written texts related to relationships, jobs, education, tourism and health. Similarly, they will listen to recordings and talks about motivations in certain companies, job interview, life decisions, talents, tourism, and will show their understanding through different activities. Students will write paragraphs with appropriate sentence structures regarding work experience, work-life balance, talents and trips. Students will orally describe and give opinions about their personal life style, happiness, their majors, their own and other people's talents, tourism and health. The students will use learning strategies and self-monitoring to become responsible for their own learning. Finally, students will use Communication Technologies (ICT) to support their learning processes.
- b. Prerequisites or co-requisites: 62132 English 2
- c. Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required

**5. Specific goals for the course**

- a. Upon completion of this course, students will be able to:

- Speaking. the student can: start and end a conversation about his/her personal feelings and emotions. • talk about his personal life as well as others'. • discuss likes and dislikes responding and asking more questions to keep the conversation going. • describe different kind of jobs. • use appropriate grammar structures and language of negotiation. Avoid hesitation, pronounce and intonate without interfering with communication. discuss and exchange information about tourism.
  - Writing. The student can: • use a variety of connectors and linking words to make the written composition easy to read. • include simple and present perfect structures in the paragraph. • write about things they like and dislike. write an application form.
  - Listening. The student can: • identify the general and specific details in the spoken discourse. • identify general and specific information from academic recordings. Understand the main points of a variety of recordings when people talk about their jobs and talents. • show understanding by completing multiple choice exercises.
  - Reading: The student can: • read and show understanding of written discourse taken from different resources. • identify main and specific ideas from academic texts. • recognize the general line of argument in a text but not necessarily in detail. • understand articles and reports concerned with contemporary problems in which the writers adopt particular stances and/or viewpoints. • identify and obtain the general and specific details in the discourse. • identify the main conclusions in clearly signaled opinion texts. • identify thesis statements from academic texts.
- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
- (g). An ability to communicate effectively

## **6. Brief list of topics to be covered**

- Topics: Life, Work and Time out.
- Vocabulary related to: Free time, relationships, collocations, jobs, work, holidays, likes and dislikes, activities to keep balance.
- Grammar structures: Verb tenses revision: simple past, simple present, present continuous, future with will and be going to; adverbs of frequency, verb patterns for expressing likes and dislikes. Second Term  
Topics: Great Minds, Travelling and Fitness.
- Vocabulary related to: Travel items, talents, education, journeys, health, food and superfoods.
- Grammar structures: Present perfect vs. simple past/ can (possibility), have to, must, should/ , make vs do, simple past vs past continuous, verb patterns.

**1. Course number and name**

578001 Core Curriculum Person and Culture I.

**2. Credits and contact hours**

Credits: 2

Attendance hours: 2 per week

Autonomous work: 2 per week

**3. Text book, title, author, and year**

- Yepes Stork, R., Aranguren Echavarría, J. (2009). Fundamentos de antropología filosófica: un ideal de la excelencia humana. 6ª ED. España: Eunsa. ISBN 13: 9788431316228 / Cap. 1, págs.. 21-27.
- Bicocca, M. (2011) La persona humana y su formación en Antonio Millán-Puelles. Pamplona: Editorial Eunsa. Cap. 4, págs. 102-113. ISBN: 9788431328238
- Sélles Dauder, J. F. (2006) Antropología para inconformes. 3ª ED. España: Rialp. ISBN: 9788432135965
- Aristóteles. (2009) Ética a Nicómaco. Madrid: Centro de Estudios Políticos y Constitucionales. ISBN: 9788425909559
- Isaacs, D. (2010) La educación de las virtudes humanas. 15ªED. Pamplona: Eunsa. Ediciones Universidad de Navarra. ISBN: 9788431327040
- Gaja Jaumeandreu, R. (2015) Bienestar, autoestima y felicidad. Barcelona: Penguin Random House Grupo Editorial. 6ªED. ISBN: 9788499086323

**4. Specific course information**

- a. brief description of the content of the course (catalog description).  
The purpose of this course is encouraging in the student the reflection on the aspects that constitute the human nature and the personal being and that reaches a theoretical synthesis in the respect.
- b. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required.

**5. Specific goals for the course**

- a. Upon completion of this course, students will be able to:
  - Evidences the integration of the human faculties in their corporal base and that identifies the aspects according to which the corporal dimension transcends.
  - Understands the characteristics of maturity proper to his chronological age.
  - Identify the behaviors that manifest a high self-esteem.
  - Develop a critical and realistic thinking about the balance between their qualities and defects.

- Identify freedom as a capacity for self-determination to act and the limits of human freedom.
  - Discover happiness as the universal aspiration of human beings and their relationship to love and fullness of life possible.
  - Recognize the need to cultivate an appropriate emotional climate in family relationships.
  - Identify the characteristics of human care practiced in the home.
  - Choose the most appropriate technological tools to fulfill the proposed objectives.
- a. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
- (f) An understanding of professional and ethical responsibility.

**6. Brief list of topics to be covered**

- Identity and self-esteem
- Close relations
- Human perfection processes in the family
- Family values
- Friendship

**1. Course number and name**

21301 Multivariable Calculus

**2. Credits and contact hours**

Credits: 3

Attendance hours: 4 per week

Autonomous work: 5 per week

**3. Text book, title, author, and year**

- Stewart James, Calculus of several Variables, Early Transcendentals. Seventh Edition.
  - Thomas B. George, Pearson, Calculus of several Variables, Twelfth edition, México 2010.
  - Larson Ron, Hostetler P. Robert, Bruce H. Edwards, Calculus II of Several Variables. Eighth Edition, Mac Graw Hill, México 2006.
- a. other supplemental materials
- Apostol M. Tom, Calculus II. Calculus with multi-variable functions and Linear Algebra, With applications for differential equations and probability
  - Demidóvich B. P , 5000 problems of mathematical analysis, Ninth Edition , Thomson , España, 2003.

**4. Specific course information**

- a. brief description of the content of the course (catalog description).

The purpose of this course is give students the knowledge of multivariable calculus, the extension of calculus to more than one variable, in the context of vector fields. The course includes many important applications in physical quantities.

- b. prerequisites or co-requisites. 21201 Integral Calculus – 21301 Linear Algebra
- c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required.

**5. Specific goals for the course**

- a. Specific outcomes of instruction, ex.

Students will be able to:

- The student computes partial derivatives in order to obtain information about functions in several variables taking to account level curves, directional derivatives, implicit derivatives and the gradient vector field.
- The student computes the flux of a vector field in  $\mathbb{R}^3$  along a surface via surfaces integrals or Stokes theorem or Gauss's theorem.
- The student computes the work of a vector field in  $\mathbb{R}^2$  or in  $\mathbb{R}^3$  via line integrals, the fundamental theorem of calculus or Green's theorem.
- The student calculates the volume of a solid in  $\mathbb{R}^3$  via double or triple integrals.

- The student solve multivariable optimization problems with and without equality constraints.
  - The student calculates the mass and the center of mass of a region in  $R^2$  or of a solid in  $R^3$  via double or triple integrals.
- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
- (a) an ability to apply knowledge of mathematics, science, and engineering

#### 6. Brief list of topics to be covered

- Product point  $r_3$  and its properties.
- Cross Product in  $R^3$  and its properties
- Equation of lines and planes in  $R^3$
- Cylinders and quadratic surfaces in  $R^3$ .
- Functions of several variables
- Partial derivatives
- Tangent planes
- Chain rule and implicit derivation
- Directional derivatives and vector gradient
- Minimum and minimum values
- Lagrange multipliers.
- Double integrals on rectangles
- Iterated Integrals
- Double integrals on general regions
- Polar coordinates
- Double integrals in polar coordinates
- Triple Integrals
- Triple Integrals in Cylindrical Coordinates
- Triple integrals in spherical coordinates
- Applications of multiple integrals
- Change of variables in multiple integrals
- Vector functions and curves in  $R^3$
- Vector fields
- Line integral
- The fundamental theorem for line integrals
- Green's Theorem
- Rotational and divergence
- Parametric surfaces and their tasks
- Surface Integrals
- Stokes's Theorem
- The Divergence Theorem

**1. Course number and name**

21302 Physical electricity and magnetism

**2. Credits and contact hours**

Credits: 4 - Attendance hours: 5 per week - Autonomous work: 7 per week

**3. Text book, title, author, and year**

- Halliday & Resnick, Fundamentals of physics, tenth edition, ISBN: 978-1-118-23072-5, Wiley, 2014.
- Sears, Semanski , University Physics, Volume 1 , Pearson, 12 Edition.
- Giancoli, Physics for Scientists and Engineers with Modern Physics, Fourth Edition, 2014.
- a. other supplemental materials
  - Serway Raymond ,Jewett John . Physics for science and engineering, volume 2, cengage Learning, Ninth Edition.

**4. Specific course information**

- a. brief description of the content of the course (catalog description).

The purpose of this course is to introduce to the quantitative aspects of physical mechanics application of fundamental concepts in physics and mathematics. The course includes topics like electric fields, Gauss' law, electrical potential, current, resistance and the application of these contexts in the experimental laboratory
- b. prerequisites or co-requisites. 21202 physical mechanics.
- c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required

**5. Specific goals for the course**

- a. students will be able to:
  - Apply the properties of electric charge to compute a particle state of movement by using the electric field from several charge distributions, the electric flux or by means of energy conservation.
  - Apply Kirchhoff rules and Ohm law to compute currents, voltages and power on any direct-current circuit element with resistances and capacitors.
  - Determine the magnetic force and torque on charged particles, wires with current, current loops and other configurations.
  - Compute the induced fem due to changes in magnetic flux on several configurations including the computation of inductance, applying this also to the study of RLC circuits.
  - Apply Maxwell equations and identifies the different regions of the electromagnetic spectrum.
- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
  - (a) an ability to apply knowledge of mathematics, science, and engineering



(b) an ability to design and conduct experiments, as well as to analyze and interpret data.

#### 6. Brief list of topics to be covered

- Properties of the electric charge: quantization, conservation, Conductors and insulators.
- Coulomb law. Principle of overlap.
- Definition of electric field. Electrical field of point loads and continuous distributions and Electric field lines, Electrical dipole.
- Electric flow, Gaussian law.
- Applications of the Gaussian law to various geometries and Properties of conductors.
- Electrical potential energy, Electrical potential due to point loads and continuous distributions.
- Equipotential surfaces and Relationship to electric field: Potential gradient.
- Definition and calculating of capacitance.
- Combinations and circuits with capacitors and Dielectrics and molecular models.
- Resistivity and resistance, Ohm's Law and Power in circuits.
- Combination of resistors.
- Laws of Kirchhoff, Measuring instruments and Resistance and capacitance (RC) circuits.
- Definition of magnetic field.
- Magnetic force on a moving load, Magnetic field and magnetic flux lines, Magnetic force on a current, Magnetic torques on current loops and The dipole magnetic moment.
- Magnetic field due to a moving load, Magnetic field due to a current, Magnetic force between two parallel conductors and Ampere Law.
- Faraday's Law and Lenz's Law, Induction and energy, Induced electric fields, Inductors and Inductance, Self-induction.
- Mutual inductance and RL, RLC circuits.
- Displacement current,
- Integral and differential form of the Maxwell equations.
- Electromagnetic waves and Electromagnetic spectrum.

**1. Course number and name**

122304 Probability and statistics I

**2. Credits and contact hours**

Credits: 2

Attendance hours: 4 per week

Autonomous work: 2 per week

**3. Text book, title, author, and year**

- WALPOLE , Ronal E and Myers , Raymond H and Myers , Sharon L, Keying ye, Probability and statistics for engineers -Ninth Edition , Pearson Education, 2012.
- ANDERSON , David R , Sweeney , Dennis J , Williams , Thomas A, Statistics for administration and economy - Tenth Edition , Cengage Learning , 2008.
- CANAVOS, George, Probability and statistics , Mc. Graw Hill , 1998.

other supplemental materials

- MONTGOMERY AND DOUGLAS , Probability and statistics applied to engineering. Second Edition , Limusa , 2013.

**4. Specific course information**

a. brief description of the content of the course (catalog description).

The purpose of this course is give students knowledge about continuous and discrete probability functions.

b. prerequisites or co-requisites. 21201 Integral Calculus

c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required

**5. Specific goals for the course**

a. Specific outcomes of instruction.

Students will be able to:

- Classify data sets by differentiating characteristics that identify the types of variables.
  - Represent similar datasets using tables and graphs.
  - Identify cause-effect relationship by applying the conditional probability calculation.
  - Use discrete and continuous probability distributions to solve problems that can be associated with the usual distributions.
  - Use probability distributions to model the behavior of centralization and dispersion measurements of a set of data.
- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
- (a) an ability to apply knowledge of mathematics, science, and engineering

## 6. Brief list of topics to be covered

- Definitions of population, parameters, deterministic models, probabilistic models and sample, Basic concepts of census and sampling and Presentation of EXCEL tools
- Definition of variable and types of variables (qualitative and quantitative).
- Definition and examples of types of qualitative and quantitative variables.
- Description of data numerically and graphically.
- Numerically: Frequency distributions for quantitative variables and grouped data.
- Graphically: Diagram, frequency histograms, frequency polygon, and ogive graph, bar diagram and circular diagram.
- Measures of central tendency (Average, Median and Fashion).
- Quarters and Boxplot.
- Dispersion Measures (Variance, Standard Deviation and Range).
- Definition of sample space and events, Venn diagrams and event algebra, Counting sample points, Axioms of Probability, Probability of an event and equiprobable events, Independent events, Conditional Probability, Independence and Rule of Product, Total probability theorem and Bayes' Theorem.
- Concept of random variable - Continuous probability distributions
- Discrete probability distributions.
- Expected value and expected value properties.
- Calculation of expected value of discrete and continuous random variables
- Variance of a random variable and Standard Deviation.
- Discrete Uniform Distribution - Distribution of Bernoulli - Binomial Distribution - Hypergeometric Distribution - Distribution of Poisson.
- Uniform Distribution - Normal distribution - Applications of the Normal distribution
- Approximation of the Binomial distribution to a Normal distribution.
- Distribution t-student, Distribution Chi-square, Distribution F and Distributions with Excel.
- Random sampling.
- Sample Distributions.
- Distribution of the Mean and Central Limit Theorem.
- Sampling Distribution for variance.

**1. Course number and name**

81106 Introduction to Administration

**2. Credits and contact hours**

Credits: 2

Attendance hours: 3 hours per week

Autonomous work: 3 hours per week

**3. Text book, title, author, and year**

- Bernal Cesar, (2014): Second Edition, Introduction to the Administration of Organizations, Bogotá, Pearson Publishing.
- Robbins S. and Coulter M. (2010) Decima Edition, Administration. Editorial Pearson. Mexico.
- Griffin R and Ebert R. (2005) Seventh Edition, Business. Editorial Pearson. Mexico.
  - a. other supplemental materials
- Gallo, Carmine. (2011). The secrets of Steve Jobs. Editorial Norma. Torres, Sergio; Mejia, Andres (2006) A contemporary view of the concept of management. Notebooks, v. 19 (32), pp. 111 - 134

**4. Specific course information**

- a. brief description of the content of the course (catalog description).

The purpose of this course is introducing students to the knowledge of administrative discipline and observation of organizational reality in national, international and global companies in order to appropriate theoretical concepts; as well as through the empirical work to visualize the complexity of the world of administration

- b. prerequisites or co-requisites. None
- c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required.

**5. Specific goals for the course**

Specific outcomes of instruction.

Upon completion of this course, students will be able to:

- Understand the concepts of Management and Organizations and describe the nature of management and the importance to modern organizations of the work of managers and CEOs.
  - Describe the different types of managers that are in the levels and areas of an organization.
  - Understand the four functions of the administrative process: Planning, Organization, Direction and Control.
  - Identify the purpose and scope of the basic functional areas of a company.
- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

(h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

**6. Brief list of topics to be covered**

- Fundamentals of administration
- Administrative process - Planning
- Administrative process - Organization
- Administrative process - Control
- Functional areas - Human Talent
- Functional areas - Marketing
- Functional areas - Production
- Functional areas - Finance

**1. Course number and name**

21304 Object Oriented Programming

**2. Credits and contact hours**

3 Credits

4 Contact hours

5 Independent work

**3. Text book, title, author, and year**

No guide book is followed

a. other supplemental materials

- Fundamentos de programación. Villalobos Jorge. Pearson Editores
- Java 2, Fundamentos. Cay Hortsman. Prentice Hall
- Think in java. Bruce Eckel – Prentice Hall
- How to program Java. Deitel y Deitel. Pearson Editores
- Análisis y diseño orientado a Objetos. Simon Bennet, McGrawHill
- Ingeniería de Software Orientada a Objetos. Bernd Bruegge. Prentice Hall

**4. Specific course information**

a. brief description of the content of the course (catalog description).

It is intended in this course that the student develop the necessary skills and competences from the point of view of the analysis of a problem, the description, organization and documentation of processes and the logic of Object Oriented Programming under the Java language

b. prerequisites or co-requisites. 21106 Introduction to Computer Programming.

c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required.

**5. Specific goals for the course**

a. Specific outcomes of instruction, ex.

- The present course aims to deepen two fronts of knowledge: In the knowledge of the object-oriented **programming** paradigm and in the student's ability to generate designs and basic support systems for information management. In the other hand, strengthen student skills and self-confidence as an architect of solutions to information management problems.
- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.  
(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

**6. Brief list of topics to be covered**

- The concept of class
- The concept of object

- Object structure
- Objects communication
- Relations between objects: Composition, usability.
- Containers. Vector and ArrayList Class
- Collection management
- Synchronicity
- Persistence in flat (text) files
- Input- Output Operations in files
- Handling exceptions
- Inheritance concepts
- Abstract classes
- Interfaces
- Graphical components (Swing -AWT technologies)
- Mouse and keyboard interaction
- Data Validation

**1. Course number and name:**

62134 English Level 4

**2. Credits and contact hours:**

Credits: 3

Contact hours: 4

Individual work hours: 5

**3. Text book, title, author, and year**

- Atwell, N. (2002). Lessons that change writers. United States: Heinemann.
- Barker, H, Cunningham, S & Moor, P. (2008). New Cutting Edge Pre-intermediate. (5th ed.). China: Pearson Education Limited.
- Clare, A & Wilson, J. (2013). Speakout Pre-intermediate. (7th ed.). Slovakia: Pearson Education Limited.
- Pearson-intlcom. (2016). Pearson-intlcom. Retrieved 18 October, 2016, from <https://myenglishlab.pearson-intl.com/>
- Davis, R. (1998 - 2015). Esl-labcom. Retrieved August, 2015, from <http://www.esl-lab.com/>
- McGraw-Hill, (Ed). (2010). Writer's Choice. (1st ed.). Columbus: McGraw-Hill.
- Soars, J & Soars, L. (2004). New Headway Pre-intermediate. (4th ed.). England: Oxford University Press.
- Universidad de la sabana. (2016). Virtual Sabana. Retrieved 18 October, 2016, from <http://virtual.unisabana.edu.co/>
- Universidad de la sabana. (2016). Unisabana Live. Retrieved 18 October, 2016, from <http://live.unisabana.edu.co/Login2.aspx?SourceURL=/>

**4. Specific course information**

- a. description of the content of the course (catalog description)
- b. Students will be able to read and analyze written texts related to social issues such as life changes, money, technology, society, nature and fame. Similarly, they will listen to and use critical thinking to predict, and draw conclusion of recordings and talks about life changes, money, technology, society, nature and fame. Students will produce 3 written compositions in which they will narrate, expound, compare and provide their opinion about social topics and their application in their own lives. Students will orally describe and give opinions about environmental problems, crime and the use of technology. Students will use information, communication, technologies (ICT) and learning strategies to become responsible for their own learning.
- c. Prerequisites or co-requisites: 62133 English Level 3
- d. Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required



## 5. Specific goals for the course

- Reading. Analyze and compare informative texts or reports about life changes money, nature, technology and crime. Find and interpret general information about environment, technology and fame. Identify specific information from texts about life changes, money, technology and nature. Guess the meaning of unknown words from the context. Associate prior to new knowledge in factual texts. Determine the author's purpose of informative texts. Skim and scan texts to check detailed information.
  - Listening. Identify the main idea of a conversation. Describe general and specific information related to life changes money, nature, technology. fame and crime. Complete texts with specific information (nouns, adjectives, verbs and figures). Understand and extract essential information from short passages that deal with every topics. Predict or anticipate ideas from a spoken text based on prior information. Identify speakers' points of view and ideas. Render the message using own words. Take notes about specific information related to technology, fame, crime, and nature.
  - Speaking. Express ideas and opinions about life changes, money, nature, technology and fame using the vocabulary and grammar studied. Keep up a conversation about life changes, money, nature, technology and fame. Use appropriate pronunciation and intonation. Ask and answer questions related to their lives. Have short conversations about topics of interests. Debate about the importance/impact of technology in today's society. Record a video about crime. Design, describe and explain money making ideas. Present and defend a point of view.
  - Writing. Use an appropriate rhetorical structure for 3 texts about life changes, environmental issues and cities. Use connectors, linking and transition words to write a cohesive text. Use grammar structures learnt to express ideas and opinions. Spell and punctuate accurately. Draft ideas before writing. Follow a model to write a paragraph using an appropriate structure. Write a 100 to 120 word narrative paragraph about a life changing experience. Write a 100 to 120 word expository paragraph about an environmental issue. Write a two-paragraph comparing and contrast composition about cities.
- a. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
- (g). An ability to communicate effectively

## 6. Brief list of topics to be covered

- Topics: changes, money, nature
- Grammar: used to – purpose, cause and result (to, so, because, in order to) - relative clauses – too much/many enough and very – comparatives and superlatives – articles.
- Vocabulary: collocations (phrasal verbs) - used to - money - nature.

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- Topic: society, technology, fame
- Grammar: present and past passive, present perfect, first and second conditional.
- Vocabulary: describing a city, crime and punishment, feelings, internet terms, films and fame.

**1. Course number and name**

578002 Core Curriculum Person and Culture II.

**2. Credits and contact hours**

Credits: 2

Attendance hours: 2 per week

Autonomous work: 2 per week

**3. Text book, title, author, and year**

- Bauman, Z. (2005) Amor líquido: acerca de la fragilidad de los vínculos humanos. España: Fondo de Cultura Económica. ISBN 13: 9788437505886
- Conen, C. (2012) Amor sólido: una mirada al pensamiento de Kaol Wojtyla. 4ªED. Buenos Aire: Editorial Dunken. ISBN: 9789870259886
- Biblioteca: Sí.
- Twain, M. (2009) El diario de Adán y Eva. 2ªED. Madrid: Valdemar. ISBN: 978-84-7702-630-3.
- Contreras, J (2009) El sexo en pareja: ¿une o desune? Madrid: Ediciones Internacionales Universitarias. ISBN: 9788484692751

**4. Specific course information**

- a. brief description of the content of the course (catalog description).

The purpose of this course is that the student value the process of dating and find wealth in marriage as a vocational path.

That the student understands that the exercise of sexuality brings consequences generated by the decisions that are made in the experience of the affective relationships so that he can be held responsible for his actions.

- d. prerequisites or co-requisites. 578001 Core Curriculum Person and Culture I.
- e. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required.

**5. Specific goals for the course**

- a. Upon completion of this course, students will be able to:
- Respond clearly to key questions: who am I? How am I as male or female? to understand complementarity in sexual diversity.
  - To know and value the anthropological keys to live a sustainable love.
  - Understand the importance of living the natural stages of maturing love to build strong relationships.
  - Identify, understand and value elements to live harmonious and sustainable relationships
  - Understand that the exercise of sexuality brings consequences generated by the decisions that are made in the experience of the affective relationships so that he can be held responsible for his actions.
  - Identify freedom as a capacity for self-determination to act and the limits of human freedom.

- Discover happiness as the universal aspiration of human beings and their relationship to love and fullness of life possible.
  - Recognize the need to cultivate an appropriate emotional climate in family relationships.
  - Identify the characteristics of human care practiced in the home.
- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
- (f) An understanding of professional and ethical responsibility.

**6. Brief list of topics to be covered**

- Engagement and marriage
- Affectivity and Sexuality

**1. Course number and name**

80105 Differential equations

**2. Credits and contact hours**

Credits: 3

Attendance hours: 4 per week

Autonomous work: 5 per week

**3. Text book, title, author, and year**

- Zill, Dennis and Cullen, Michael. Ecuaciones differential equations with problems with border values, Eighth Edition; Cengage Learning. México D.F.2014.
  - Boyce, William and the Prima, Richard .Elemental Differential Equation and Boundary Value Problems. Ninth Edition. John Wiley and Sons, Inc. United States of America, 2009.
  - R.k .Nagle and E.B. Saff Fundamentals of differential equations , Addison – Wesley , Iberoamericana, 1992 .
- a. other supplemental materials
- Kiseliiov, M. Krasnov and Makarenko, Problems of Ordinary Differential Equations, Mir Moscú, 1968.

**4. Specific course information**

- a. brief description of the content of the course (catalog description).  
The purpose of this course is give students the knowledge for model laws of nature in terms of differential equations, solve those equations and interpret the solutions. The course includes many applications in science and engineering.
- b. prerequisites or co-requisites. 21301 Vector calculus.
- c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required

**5. Specific goals for the course**

- a. Specific outcomes of instruction, ex.  
This course requires previous knowledge on calculus in single and several variables and linear algebra. Upon completion of this course, students will be able to:
- Solve ordinary differential equations using different methods of solutions, such as: separable variables, integrating factor, Cauchy-Euler equation, variation of parameters and Laplace transform.
  - Model basic physical systems employing differential equations.
  - Identify the solutions of a linear differential equation of higher order like a combination linear of a fundamental set of solutions
  - Solve systems of first order differential equations in applied problems.

- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
- (a) an ability to apply knowledge of mathematics, science, and engineering

**6. Brief list of topics to be covered**

- Definition, order, degree, general solution and particular solution of a differential equation
- Initial Value Problems
- Differential equations of separable variables
- Homogeneous differential equations
- Exact differential equation
- First order linear differential equation
- Bernoulli differential equation
- General notions
- Linear and determinant independence of Wronskian
- Fundamental set of solutions
- Characteristic equation
- Differential equation of Cauchy-Euler
- Reduction of order
- Variation of parameters
- Applications
- Definitions and Properties
- The convolution theorem
- Initial value problem solving
- Solution of simultaneous differential equations
- Solution of convolutive integral-differential equations
- Basic notions
- Homogeneous linear systems
- Non-homogeneous linear systems

**1. Course number and name**

801401 Physical materials

**2. Credits and contact hours**

Credits: 2

Attendance hours: 3 per week

Autonomous work: 5 per week

**3. Text book, title, author, and year**

- William Callister, Fundamentals of materials science and engineering: An integrated approach, eighth edition, John Wiley & sons.
- William F. Smith, Javad Hashemi, Fundamentals of science and engineering materials, fifth edition, Mc Graw Hill, 2014 .
- James Jacobs, Tomas Kilduff, Engineering Materials Technology, fifth edition, Pearson, 2005
  - a. other supplemental materials
- Donald Askeland Introduction to materials science and engineering, volume 2 , Pearson , 12 Edition .
- Michael Ashby, David Jones, Materials for engineering editorial Reverts, 2008.

**4. Specific course information**

- a. brief description of the content of the course (catalog description).  
This course explores several phenomena that cover topics from electromagnetic physics to quantum physics; special emphasis on contemporary applications of material science through case studies of magnetic materials, compounds, alloys, polymers, semiconductor and photonic materials, among others.
- b. prerequisites or co-requisites. 21202 - Physics Mechanics, 21302 - Physics Electricity and Magnetism
- c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required

**5. Specific goals for the course**

- a. Specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.  
Upon completion of this course, students will be able to:
  - Describe the properties of a material at an atomic and molecular scale, and to understand how they affect the macroscopic features of the material and determine its functionality.
  - Determine, based on laboratory measurements and the application of theoretical models, the characteristic macroscopic properties of a material; and to infer, from their results, possible applications of the materials.
  - Comprehend the manufacturing techniques of different kinds of materials and to understand how they relate with the features of the final product.

- Incorporate criteria of functionality, working conditions, costs, environmental impact and in general, of possible advantages and disadvantages compared to other possibilities, when deciding which material to use for specific applications.
- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
  - (e) An ability to identify, formulate, and solve engineering problems.

#### 6. Brief list of topics to be covered

- Atomic Structure
- Link types
- Strength and bond energies
- Types of materials according to the link: Metals, ceramics, polymers, and composites.
- Crystal structures
- Polycrystalline materials, amorphous materials
- Defects and imperfections of solids.
- Polymorphism and allotropy.
- Tension - Deformation
- Cutting, shearing, bending, torsion, tenacity, etc.
- Stress-deformation tests: Hooke's law, elastic constants calculation.
- Density
- Fusion Points
- Specific heat
- Conductivity and thermal expansion
- Electrical and magnetic properties
- Alloys of aluminum
- Study cases
- Introduction to phase diagrams
- Thermoplastics, Thermosets
- Elastomers
- Identification tests
- Study cases
- Properties
- Structure
- Types
- Matrices and reinforcements of various types and Study cases



**1. Course number and name**

21402 Probability and statistics II

**2. Credits and contact hours**

Credits: 3

Attendance hours: 4 per week

Autonomous work: 5 per week

**3. Text book, title, author, and year**

- Walpole , Ronald E and Myers , Raymond H and Myers , Sharon L. Probability and statistics. Person Education. 9 Edition 2012.
  - Navidi, William Cyrus . Statics for engineers and scientists . Mac Graw Hill Higher Education. Third Edition. 2011.
- a. other supplemental materials

**4. Specific course information**

- a. brief description of the content of the course (catalog description).  
The purpose of this course is give students the knowledge for analysis data, decision theory, estimation, confidence intervals, and hypothesis testing. The course includes the input analysis, and interpretation of generated output.
- b. prerequisites or co-requisites.: 122304 Probability and statistics I.
- c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required

**5. Specific goals for the course**

- a. Specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.
- This course requires previous knowledge on basic concepts of probability theory. Upon completion of this course, students will be able to:

- Construct confidence intervals for population coefficients based on data samples.
- Identify the appropriate hypothesis test based on the selected statistical model and the sample size; calculates p-values.
- Identify whether or not, a data sample comes from a random variable with a particular distribution.
- Propose a statistical model to fit experimental data, in which the variance is allocated into certain components due to different explanatory variables.
- Estimate the parameters of a model representing the relationship between two or more experimental variables, transforming them to fit a linear model.

- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
- (a) an ability to apply knowledge of mathematics, science, and engineering
  - (b) an ability to design and conduct experiments, as well as to analyze and interpret data.

**6. Brief list of topics to be covered**

- Classical methods of estimation
- Two samples: Estimating the radio variance, proportion and mean.  
Test of hypotheses
- Test on single samples
- Test on two samples
- Evidence related to variance
- Nonparametric statistics.
- Wilcoxon rank-sum test
- Least squares estimate
- Statistical inference about regression parameter
- Transformation to linearity

**1. Course number and name**

21403 Introduction to Fluid Mechanics

**2. Credits and contact hours**

Credits: 2

Attendance hours: 3

Autonomous work: 5

**3. Text book, title, author, and year**

- CENGEL, Fluid Mechanics, MC Graw Hill, Mexico, 2008.
  - MOTT, Robert L. Applied fluid mechanics. Fourth edition. Mexico: Prentice-Hall Hispano-Americans, 1996. 580p.
  - GERHART, GROSS, HOCHSTEIN, Fundamentals of Fluid Mechanics, Addison-Wesley, Iberoamericana, Buenos Aires, 1995.
- a. other supplemental materials
- STREETER, Victor L., WYLIE, E. Benjamin, BEDFORD, Keith W. Fluid Mechanics. Ninth edition. Bogotá: McGraw-Hill Interamericana, S.A., 2000. 740p.
  - FRANZINI, Joseph B., FINNEMORE, E. John. Fluid mechanics with applications in engineering. Ninth edition. Madrid: McGraw-Hill Interamericana de España, S.A., 1999.

**4. Specific course information**

- a. brief description of the content of the course (catalog description).  
The purpose of this course is to provide students with the fundamental knowledge and skills of static and fluid dynamics, their analysis, understanding and application to real systems.
- b. prerequisites or co-requisites. 21202 Mechanics Physics
- c. Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required.

**5. Specific goals for the course**

- a. Specific outcomes of instruction.  
Upon completion of this course, students will be able to:
- Apply mathematics, basic sciences and engineering to real problems.
  - Design and propose optimal systems, components or processes to meet real needs.
  - Identify, formulate and solve engineering problems.
  - Use various modern techniques to solve problems of engineering practice.
- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
- (a) An ability to apply knowledge of mathematics, science, and engineering.
- (e) An ability to identify, formulate, and solve engineering problems.

**6. Brief list of topics to be covered**

- Notation. Units.
- Density. Capillarity. Viscosity.
- Kinematics and dynamic viscosity.
- Newton's viscosity law.
- Hydrostatic pressure.
- Principle of Pascal.
- Pressure gauges and pressure measurements: Isobaric surfaces.
- Transfer of energy and force exerted by the fluid: Hydraulic press.
- Hydrostatic force on surfaces.
- Floating and stability of floating object objects.
- Acceleration.
- Continuity equation: Mass, momentum, energy.
- Energy aspects of the movement of fluids: Bernoulli equation.
- Dynamic pressure.
- Laminar flow.
- Viscous flow.
- Loss of energy by viscosity.
- Turbulent flow.
- Measures of viscosity.
- Introduction to Computational Fluid Mechanics.
- Flow of compressible fluids. Example: Air.
- Introduction and similarities.
- Dimensional numbers.
- Theorem Pi of Buckingham.
- Friction losses.
- Minor losses: Valves, reductions, elbows, etc.
- Limit layer flow.
- Drag and lift: Mills, Aircraft, etc.

**1. Course number and name:**

62135 English Level 5

**2. Credits and contact hours:**

Credits: 3

Contact hours: 4

Individual work hours: 5

**3. Text book, title, author, and year**

- Anderson, C. (2016). Ted Talks. United States of America: Houghton Mifflin.
- Dummett, H, Hughes, P & Stephenson, H. (2013). Life Intermediate. (1st ed.). United Kingdom: Cengage Learning.
- Dummett, H, Hughes, P & Stephenson, H. (2013). CD ROM. [CD ROM]. United Kingdom: Cengage Learning.
- Heinlecom. (2016). Heinlecom. Retrieved 18 October, 2016, from <https://myelt.heinle.com/ilrn/authentication/signIn.do?inst=MYELT>
- Sayer, M. (2013). Life Intermediate Teacher's Book. United Kingdom: Cengage Learning.

**4. Specific course information**

- a. Brief description of the content of the course (catalog description)  
By the end of level 5, students will show understanding of written and oral texts related to the use of color in life and its meaning, music, performance, global entertainment, unforgettable experiences, predictions, travel experiences, great holidays and healthy lifestyles. Similarly, students will produce written compositions in which they will identify the causes or effects of globalization and how it has affected different aspects of local and worldwide culture. Students will describe unforgettable experiences, talk about predictions, exchange information about travel experiences and holidays, discuss and share their opinions on healthy lifestyles. Students will use Information, Communication Technologies (ICT) and learning strategies to become responsible for their own learning.
- b. Prerequisites or co-requisites: 62134 English Level 4
- c. Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required

**5. Specific goals for the course**

- a. Specific outcomes of instruction,  
Speaking: The students can agree and disagree with situations related to how globalization has affected culture sharing causes and effects. They also talk about the impact of tourism in natural settings. Learners will identify the importance of education and its impact in different places of the world.

Writing: The students can write a four-paragraph cause and effect composition following the rhetorical structure expected for this type of texts.

Listening: The students can identify the general and specific details in the spoken discourse identifying information from academic recordings. Learners can listen to a text and fill in the gaps, answer True/False sentences and justify their answers.

Reading: The student can read and follow written discourse taken from media sources such as newspapers and magazines identifying main and specific ideas from academic texts. Also, they can recognize the general line of argument in a text but not necessarily in detail.

- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
  - (g). An ability to communicate effectively

#### **6. Brief list of topics to be covered**

- Topics: Colour, performance, water.
- Vocabulary related to: Color-personality, Color-culture. Globalization, Musical styles – adjectives to describe musical styles. Tourism and its impact in the environment.
- Grammar structures: Present simple – Present continuous - question forms – Present perfect (just, yet, already) – past perfect simple.
- Topics: Opportunities, travel, wellbeing.
- Vocabulary related to: Education terms, Holiday destinations, Travel problems, Healthy habits.
- Grammar structures: Past Perfect Simple – Present perfect simple Vs simple past- Future forms-- First Conditional.

**1. Course number and name**

578003 Core Curriculum Person and Culture III.

**2. Credits and contact hours**

Credits: 2

Attendance hours: 2 per week

Autonomous work: 2 per week

**3. Text book, title, author, and year**

- Lorda, J. L. (2015). Antropología teológica. 2<sup>a</sup> ed. Pamplona: Ediciones Universidad de Navarra. ISBN: 9788431329105
- Ivereigh, A. & Cierva, de Y. (2016). Cómo defender la fe sin levantar la voz: respuestas civilizadas y preguntas desafiantes. Madrid: Palabra. ISBN: 9788490614389
- Izquierdo, C., Burggraf, J., & Arocena, F. M. (2014). Diccionario de teología. Pamplona: Ediciones Universidad de Navarra. ISBN: 9788431329792
- Hahn, S. (2008). La fe es razonable: cómo comprender, explicar y defender la fe católica. Madrid: Rialp. ISBN: 9788432137051
- Tomás de Aquino, S. (2012). Suma teológica. Parte I, Cuestión 2 "Sobre la existencia de Dios". Madrid: Biblioteca de Autores Cristianos. ISBN: 9788422014324
- Burggraf, J. (2010). Teología fundamental: manual de iniciación. Madrid: Rialp. ISBN: 9788432133831

**4. Specific course information**

- a. brief description of the content of the course (catalog description).  
The purpose of this course is show the value and necessity of a life open to transcendence and personal relationship with God, to contribute to the construction of peace and to foster hope.
- b. prerequisites or co-requisites. 578002 Core Curriculum Person and Culture II.
- c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required.

**5. Specific goals for the course**

- a. Upon completion of this course, students will be able to:
  - Encourage students in primary values such as: reflection on aspects of scope constructive and respectful dialogue on them, opening to plurality, the incorporation to the own life of the principles and values in which they believe.
  - Discover and find God.
  - Formulate and responds to fundamental existential questions.
  - Has a positive approach to faith.
- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

(f) An understanding of professional and ethical responsibility.

**6. Brief list of topics to be covered**

- Dimensions of human nature.
- Perception of a higher being
- Rites and Symbology
- Cosmological and anthropological vestiges of the existence of a higher being.
- Concept of Religion.
- Unity and plurality of religions.
- Nature and object of faith.
- Themes: origin of the universe, of life and man.
- What they say: philosophy, theology and sciences (biology, physics, medicine, psychology, etc.)
- Limits of each science.
- Knowledge of the God of the Christians in their essence.



**1. Course number and name:**

21404 Thermodynamics

**2. Credits and contact hours:**

Credits: 3, Contact hours: 4, Individual work hours: 5

**3. Text book, title, author, and year**

- ÇENGEL, Y. A. and BOLES, M. A. 2009. Thermodynamics: an engineering approach, 7th Ed., McGraw-Hill Higher Education, Boston.

a. Other supplemental materials

- WARK, K. and RICHARDS, D. E. 1999. Thermodynamics, 6th ed. Ed., WCB/McGraw-Hill, Boston ; London.
- SMITH, J. M., VAN NESS, H. C. and ABBOTT, M. M. 2005. Introduction to chemical engineering thermodynamics, 7th Ed., McGraw-Hill, Boston.
- SONNTAG, R. E., BORGNAKKE, C. and VAN WYLEN, G. J. 2003. Fundamentals of thermodynamics, 6th ed. / Richard E. Sonntag, Claus Borgnakke, Gordon J. Van Wylen. Ed., Wiley, New York, N.Y. ; [Chichester].
- POLING, B. E., PRAUSNITZ, J. M. and O'CONNELL, J. P. 2007. The properties of gases and liquids, 5th ed. International ed. / Bruce E. Poling, John M. Prausnitz, John P. O'Connell. Ed., McGraw-Hill, Boston, [Mass.]

**4. Specific course information**

a. Brief description of the content of the course (catalog description)

Determine the properties of real substances and ideal gases from tabulated data, graphs or equations of state. Analyze processes involving ideal gases and real substances as working fluids in both closed and open systems (control volumes) to determine process diagrams, apply the first law of thermodynamics to perform energy balances, and determine the heat transfer and work. Analyze systems and control volumes through the application of the second law of thermodynamics

b. Prerequisites or co-requisites

21101 - Differential Calculus

c. Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program

Required

**5. Specific goals for the course**

a. Specific outcomes of instruction,

It is expected that at the end of the course the student Apply principles of math, science, and engineering in problem solving Identify, formulate and solve engineering problems associated with open and closed systems using both ideal gases and actual substances as working fluids. Demonstrate the effective use of the Internet

to explore topics of thermodynamics related to energy generation, its transformation and the implications on society and the environment.

- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
  - (a). An ability to apply knowledge of mathematics, science, and engineering
  - (e). An ability to identify, formulate, and solve engineering problems

## 6. Brief list of topics to be covered

- Energy, thermodynamic system. Postulate of state. Process, trajectory and cycle. Properties: mass, volume, pressure and temperature. Thermal equilibrium: zero law of thermodynamics. Dimensions and units.
- Balance of energy - first law transfer of energy and types of energy
- Heat transfer. Border work and other forms of work. Internal energy. Enthalpy
- Prediction of properties. Pure substances: phases of a pure substance. Phase changes, phase diagrams t-v, p-v. Internal energy and enthalpy. Thermodynamic properties tables. Determination of properties. Ideal gas: equation of state. Relations of internal energy, enthalpy and heat capacities. Other state equations: compressibility factor and principle of the corresponding states. Incompressible substances: heat capacities of liquids and solids.
- First law in closed systems. Mass conservation and energy balance: general energy equation
- First law in control volumes. The process of permanent flow. Mass flow. Mass conservation and energy balance: general energy equation. Application to process equipment such as: boilers, turbines, compressors, heat exchangers, nozzles, diffusers, valves, evaporators, condensers
- Second law of thermodynamics. Thermal machines, refrigerator and heat pump: thermal efficiency and cop. Pronouns of Kelvin-planck and clausius. Reversible and irreversible processes. Carnot cycle. Ideal machine, maximum efficiency, maximum work. The thermodynamic temperature scale. Inverted carnot cycle. Refrigerator and heat pump. Cop maximum and minimum work.
- Concept of entropy. Degradation of energy. Principle of entropy increase. Entropy variation of the system and its environment. Entropy as thermodynamic property of liquids, vapors, gases and solids. Isentropic process and isothermal process. Entropy balance. Isentropic Efficiencies of Equipment and Apparatus

**1. Course number and name**

80251 Processes I

**2. Credits and contact:**

Credits 2

Attendance hours: 2 per week

Autonomous work: 4 per week

**3. Text book, title, author, and year**

- Mikell P. Groover. Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, 2007
- Richard B. Chase, Nicholas J. Aquilano, Production and operations management: manufacturing and services, 2013.
- Niebel, Benjamin Willard, Methods, Standards, & Work Design, 2004

a. other supplemental materials

- Full text articles from Virtual Plant, <http://www.virtualplant.net/>

**4. Specific course information**

a. Brief description of the content of the course (catalog description).

The course illustrates issues related to production management systems, their management criteria, emphasizing in a systemic conception of productive systems considering their inputs, outputs, feedback loops, and the integration of these elements from concepts such as the value chain and representation of process to study of work tools are used in a basic way. Subsequently more technical aspects are dealt with in the implementation of industrial processes, such as the physical and mechanical properties of the materials of manufacture and their relationship with various transformation operations. Finally, some of the more conventional industrial processes of molding, agglomeration, volumetric deformation and machining are studied; this in terms of its principles of operation, machines-tools used, requirements and typologies.

b. Prerequisites or co-requisites. 2140 3Fluid Mechanics.

c. Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required.

**5. Specific goals for the course**

a. Specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.

The students will be able to:

- To define for any production process the properties and characteristics required in the inputs, materials or raw materials, equipment and machinery necessary for the execution of the process. Interrelate the different stages that allow you to redefine and design new processes. Interrelate product design

with process design Execution of the process. Interrelate the different stages that allow you to redefine and design new processes.

- To visualize in a global way the way in which the processes are planned and designed.
  - To understand the different types of process design Analyze the main factors that affect the design decisions of the processes Familiarize themselves with different production processes
  - To create habits and attitudes according to the integral training that the University seeks for its professionals, such as: Study habits, accountability before the study, honesty in their evaluations and works, capacity for analysis and criticism, capacity for observation, creativity and development of Creation / adaptation.
- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
- (a) an ability to apply knowledge of mathematics, science and engineering.

#### 6. Brief list of topics to be covered

- Manufacturing, Manufacturing Components, Inputs, Initial Resources
- Process, Outputs, Capacity
- Process Components, Requirements Analysis
- Process Types, Process Ordering (system distribution)
- Process Diagram, Process Map, Path Diagram, Machine Man Diagram.
- Physical Properties of Materials in Manufacturing processes and their relationship with costs
- Product planning, Exploded view and assembly plan, Dimensions and Tolerances.
- Definition, Stages, Requirements, Types, Machine Tools and Molding of Metals and Polymers
- Requirements, Types, Machine Tools and Design, Coatings
- Volumetric Deformation - Definition, Stages, Requirements, Types, Machine Tools
- Definition, Stages, Requirements, Types, Machine Tools, Cutting, Bending
- Definition, Stages, Requirements, Types, Machine Tools, Turning, Milling
- Assembly Processes.
- Definition, Stages, Requirements, Types, Machine Tools, Welding and Mechanics
- Design of Templates and Obtaining of Standards, Traceability

**1. Course number and name**

801502 Work study

**2. Credits and contact hours**

Credits: 3

Attendance hours: 3 per week

Autonomous work: 6 per week

**3. Text book, title, author, and year**

- Freivalds, A., Niebel, B. Niebel's Methods, Standards, & Work Design, McGraw-Hill Education, 2013.
- Maynard, H.B. Industrial Engineering Handbook, Fifth Edition, McGraw-Hill, 2001.
- Heizer, J. & Render, B. Production and Operation Management Prentice Hall. 1996.
- Russell, R.S. and Taylor, B.W. Production and Operation Management Prentice Hall. First edition, New Jersey 1995

other supplemental materials

- Estrada, J. Ergonomía Universidad de Antioquia. Segunda Edición. 2001

**4. Specific course information**

- a. brief description of the content of the course (catalog description).  
Provide to student with the necessary knowledge to acquire skills and abilities in the development of work study, based on method engineering and time analysis, in order to create conditions for the professional use of these tools for standardization and improvement of productivity in companies that require it.
- b. prerequisites or co-requisites. 21402 Probability and Statistics II
- c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required.

**5. Specific goals for the course**

- a. Specific outcomes of instruction  
Upon completion of this course students will be able to:
  - Measurement and characterization of processes through the use of operation and process diagrams.
  - Build, evaluate and design new methods and new ways for the development of productive activities.
  - Use of measurement techniques, and construction of the standards of the tasks involved in productive activity.
  - Solve ergonomic analysis of job design.

- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
- (c) An ability to design a system, component, or process to meet desired needs
  - (e) An ability to identify, formulate, and solve engineering problems.

**6. Brief list of topics to be covered**

- General concepts. Definitions. Importance and effect of work study in different dimensions.
- Productivity.
- Development of the study of movements and times.
- Methods engineering. Graphical tools for the analysis and work study. Operation, flow, worker/machine, and gang process charts, and flow diagrams.
- Methods engineering: Operation analysis.
- Methods engineering. Study of movements. Principles of motion economy. Study of micro-movements.
- Time Study: time standards. Perform a time check to confirm the validity of the time study.
- Time Study: Work sampling. Planning the work sampling study. Determining standard time.
- Ergonomics. General ergonomic concepts. Man-machine interaction.
- Ergonomics. Workplace, Equipment, and Tool Design.
- Ergonomics. Work Environment Design.

**1. Course number and name**

80226 Electrotechnical systems

**2. Credits and contact hours**

Credits: 2

Attendance hours: 2 per week

Autonomous work: 4 per week

**3. Text book, title, author, and year**

- Boylestad, Robert L. (2003). Introductory circuit analysis. Upper Saddle River. N.J. : Prentice-Hall.

**4. Specific course information**

- a. brief description of the content of the course (catalog description).  
The purpose of this course is give students the knowledge for identifying power circuits in industries and they can be identify energy saving.
- b. prerequisites or co-requisites. 21302 Physics electricity and magnetic
- c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required.

**5. Specific goals for the course**

- a. Specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.  
This course requires previous knowledge on physics and circuits systems.  
Upon completion of this course, students will be able to develop economic criteria to use of electricity
- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.  
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

**6. Brief list of topics to be covered**

- Circuits of Direct Current or Continuous.
- Basic Definitions
- Equations of equilibrium
- Measurement of resistances
- Application exercises
- Alternating current
- Sine functions.
- Complex numbers and functions.
- Complex magnitudes. Equation of equilibrium of AC circuits.
- Measuring instruments

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- Methods of impedance measurement.
- The power in alternating current.
- Power in a receiver.
- The reactive power.
- Analysis of circuits by means of conservation theories of powers.
- Measurement of powers.
- Economic aspects of electricity consumption.
- The ideal transformer



**1. Course number and name**

81132 Financial Accounting

**2. Credits and contact hours**

Credits: 3

Attendance hours: 4

Autonomous work: 8

**3. Text book, title, author, and year**

- Financial Accounting –Actors: Warren –Reeve-Fess. Ninth Edition.-Editorial CENGAGE Learning- Mexico, May 2009.
- a. other supplemental materials
- Accounting –The basis for management decisions –Meigs – Williams – Haka –Bettner –Undecided .- Mc Graw Hill -2005.
- IASB – Conceptual Framework
- IASB –IAS 7

**4. Specific course information**

- a. brief description of the content of the course (catalog description).  
The purpose of this course is give students the fundamental knowledge for understand the accounting and the financial results of a company.
- b. prerequisites or co-requisites. None
- c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required.

**5. Specific goals for the course**

- a. Specific outcomes of instruction.  
Upon completion of this course, students will be able to function on teams to model systems with stochastic characteristics, then the students will be able to:
  - Understand the accounting language and use it in the presentation of financial results reports.
  - Analyze the elements of a financial results reports.
  - Use to Excel for made financial results reports.
- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
- (h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

**6. Brief list of topics to be covered**

- Accounting information in Colombia.
- Fundamental concepts of accounting Financial.
- Fundamental accounting equation.
- Financial result reports.

**1. Course number and name:**

62136 English Level 6

**2. Credits and contact hours:**

Credits: 3

Contact hours: 4

Individual work hours: 5

**3. Text book, title, author, and year**

- Sthephenson, H; Dument, P & Hughes, J.K (2013). Life intermediate. Canda: Cengage Learning Macgillivray, M & Yancey, P. (2008). Extensive Reading for academic success. Advanced C. Compass Publishing.
- Cohen, R & Miller, J. NorthStar. (2003). Reading and Writing, advanced. Person Longman Press. Anderson, N. (2002). Active skills for reading: Book 3.Thomson Learning.
- Evans, V., & Dooley, J. (2002). Upstream: Intermediate. Kraków: Wydawnictwo Egis. <http://www.ted.com/>
- Virtual Sabana-Moodle - National Geographic Virtual Library Online resources such as you.tube videos and different articles.

**4. Specific course information**

- a. Brief description of the content of the course (catalog description)

By the end of level 6, students will demonstrate a solid understanding of written and oral texts related to living spaces, weird news, trade and money use, the latest advances in medicine, inspirational people, communication, and the experts of different fields. Similarly, students will produce a written composition and orally persuade an audience and readers about the topics mentioned before. Also, students will talk, express preferences and give reasons about weird news, homes, and technological advantages in medicine, and describe a campaign in regards to money use. Furthermore, students will use Information and Communication Technologies (ICT) and learning strategies to become responsible for their own learning.

- b. Prerequisites or co-requisites: 62135 English Level 5

- c. Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required

**5. Specific goals for the course**

- a. Specific outcomes of instruction,

- Speaking. The student can provide arguments to support his opinion towards a given topic from the main objective of the course.

- Listening. The student can anticipate information to identify specific details in a conversation. The student can understand the main points of clear standard speech and relate the information to their experiences.
  - Reading: The student can show understanding of academic texts by explaining and expanding on the topics explored in the suggested texts. The students can discuss, agree and/or disagree with the topics presented in the suggested texts. Furthermore, the student can answer different type of questions (Matching headings to paragraphs, vocabulary in context, passage idea, author's purpose, factual and inferential questions).
  - Writing. The student can write accurate and complete topic sentences and paragraphs in a persuasive essay. The student can use connectors and linking words. Moreover, there is a wide use of appropriate simple and complex grammar structures.
- a. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
- g. An ability to communicate effectively

#### **6. Brief list of topics to be covered**

- Topics: Living Space / Weird News / Trade
- Vocabulary related to: Features of homes in the city, the natural world weird characteristics, money /shopping.
- Grammar Structures: Comparatives and Superlatives, Used to, Modal verbs (Speculation in present and past), Passive voice.
- Topics: No limits! /Connections / Experts
- Vocabulary related to: Medicine, Communications and Technology, Field Trips.
- Grammar Structures: Defining Relative Clauses, Second conditional, Reported Speech and Reporting Verbs, Third Conditional.

**1. Course number and name**

21501 Linear Programming

**2. Credits and contact hours**

Credits: 3

Attendance hours: 3

Autonomous work: 6

**3. Text book, title, author, and year**

- 'BAZAARA y JARVIS, Programación Lineal y Flujo en Redes, Limusa, 2005
- HILLIER y LIEBERMAN, Introducción a la Investigación de Operaciones, 7a. edición, México, Mc Graw Hill, 2003
- TAHA, Hamdy A. Investigación de Operaciones, 6a. edición, México, Prentice Hall, 1998
- PRAWDA W, Juan, Métodos y Modelos de Investigación de operaciones Tomo I, México, Limusa, 2004
- WAYNE, L. Winston, Investigación de Operaciones (Algoritmos y aplicaciones), 4a. edición, México, Thomson, 2005

**4. Specific course information**

- a. brief description of the content of the course (catalog description).

The purpose of this course is give students the fundamental knowledge for develop an operations research study, in the stages of system definition, model formulation, instrumentation, algorithmic development and interpretation of results, based on linear programming, in order to create conditions for Industrial Engineer to use tools quantitative in the decision-making processes in their professional practice.

- b. prerequisites or co-requisites. 801013 Linear Algebra.
- c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required.

**5. Specific goals for the course**

- a. Specific outcomes of instruction.

Upon completion of this course, students will be able to:

- Development a process of mathematical modeling to represent problematic situations present in the management systems of productive organizations.
- Solve linear optimization problems using algorithms.
- Using optimization software.
- Analyze, interpret and infer solutions for decision making.

- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

(a) An ability to apply knowledge of mathematics, science, and engineering.

(e) An ability to identify, formulate, and solve engineering problems.

(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

**6. Brief list of topics to be covered**

- Introduction. General concepts.
- The modeling process. Notation.
- Geometric Solution. Important Concepts.
- Formulation of classic linear models.
- The simplex method. Extensions.
- Theory of duality and Sensitivity analysis.
- The transport and allocation models. Solution Algorithms

**1. Course number and name**

578004 Core Curriculum Person and Culture IV.

**2. Credits and contact hours**

Credits: 2

Attendance hours: 2 per week

Autonomous work: 2 per week

**3. Text book, title, author, and year**

- Hosseini, K. (2003). Cometas en el cielo. Salamandra. ISBN: 9788498380729
- Dostoievski, H. (2015). Crimen y castigo. Penguin Clasicos. ISBN: 849105006X
- Ayllón, J. (2010). Desfile de modelos: análisis de la conducta ética. Ediciones Rialp. ISBN: 9788432131691
- Sonnenfeld, A. (2014). El nuevo liderazgo ético: la responsabilidad de ser libres. Madrid: Fragua. ISBN: 9788470745898
- Tolkien, J.R.R. (2006). El señor de los anillos I: La comunidad del anillo. Malaga: Minotauro. ISBN: 8445076116
- Sandel, M. (2011). Justicia: ¿hacemos lo que debemos?. Debate. ISBN: 9788483069189
- García Pelegrín, J. (2006). La Rosa Blanca. Libros Libres. ISBN: 9788496088467
- Abadía, L. (2010). La crisis ninja y otros misterios de la economía actual. Espasa. ISBN: 9788467030150
- Mutch, Barbara (2012). La hija de la criada. Alianza. ISBN: 9788420675664
- Llano, A. (2009). La vida lograda. Ariel. ISBN: 8434412322
- Pieper, J. (2003). Las virtudes fundamentales. Rialp. ISBN: 8432148318
- Sonnenfeld, A. (2012). Liderazgo ético: la sabiduría de decidir bien. Ediciones encuentro. ISBN: 9788499200460
- Lee, H. (2015). Matar a un rruiseñor. Ediciones B. ISBN: 9788468767024
- Martínez-Sáez, S. (2008). Relativismo ético. Persona y Bioética. ISSN: 0123-3122
- Murillo, J. (2009). Studia Poliana. Departamento de filosofía universidad de navarra. ISBN: 23871830
- Aristóteles (2009). Ética a Nicómaco. Centro de Estudios Políticos y Constitucionales. ISBN: 9788430948154

**4. Specific course information**

- a. brief description of the content of the course (catalog description).

The purpose of this course is provide students with the knowledge and tools necessary for each one to seek and find the path that leads to the fullness of life, through their personal choices.

- b. prerequisites or co-requisites. 578003 Core Curriculum Person and Culture III.  
c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required.

## 5. Specific goals for the course

- a. Upon completion of this course, students will be able to:
  - Understands the factors that make him grow as a person and make him an administrator of his own life.
  - Understand the importance of choosing well in order to be an authentic person.
  - Develops the different virtues that perfect him as a person, making him good.
- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
  - (f) An understanding of professional and ethical responsibility.

## 6. Brief list of topics to be covered

- Relationship between human behavior and ethics. The moral experience as a starting point for ethical reflection.
- Relationship between ethics, freedom and responsibility.
- Concepts of virtue and vice.
- Coherence and hypocrisy in human action.
- Voluntary action and its moral specification: Relationship between mind and brain.
- Willpower (want want) It is possible to improve.
- Freedom and moral habits: Difference between the spontaneous (the instinctive) and the natural (the rational).
- Acquisition of virtues or good habits.
- The role of the global conception of the human good in ethics
- Happiness as the ultimate goal (télos) of the person (Relationship between nature, freedom and human fulfillment).
- Have noble ideals. Relationship between happiness and hope. Contribution to the common good. Contemporary hedonism and skepticism.

**1. Course number and name**

802601 Operations Research I

**2. Credits and contact hours**

Credits: 3

Attendance hours: 3 per week

Autonomous work: 6 per week

**3. Text book, title, author, and year**

- Hillier, F. Lieberman, G. Introduction to Operations Research, McGraw-Hill, 2010.
- Wayne, L. W., Operations Research: Applications and Algorithms, Duxbury Press, 2003.
- a. other supplemental materials
- Taha, H.A., Operations Research, Pearson ninth Edition, 2010.

**4. Specific course information**

- a. brief description of the content of the course (catalog description).  
The purpose of this course is to provide the student with the methodologies and quantitative tools of the Markov Chains and queuing theory. The course includes transition matrices, types of Markov Chains, steady-state probabilities, birth and death processes, and M/M queues with one and multiple servers.
- b. prerequisites or co-requisites. 21501 Linear Programming.
- c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required.

**5. Specific goals for the course**

- a. Specific outcomes of instruction.

This course requires previous knowledge of probability and optimization concepts. Upon completion of this course, students will be able to model and analyze stochastic processes, therefore they will be able to:

- Verify if data satisfies Markov Chain properties
- Solve problems using Markov Chain and queuing models
- Build models using software
- Evaluate alternatives based on costs and performance indicators
- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
  - (c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
  - (e) An ability to identify, formulate, and solve engineering problems.



**6. Brief list of topics to be covered**

- Markov Chain concepts.
- Markovian and stationary properties.
- Transition matrix properties.
- Transition matrix calculation based on data.
- Hypothesis testing to verify Markovian and stationary properties.
- Markov chain modeling
- Definition of the state variables and states.
- Calculate probabilities using tree diagrams.
- Chapman-Kolmogorov equations
- n-step transition matrix.
- Initial state vector.
- Classification of states of a Markovian Chain
- Recurrent, transient
- Absorbing states.
- Periodicity property.
- Recurrent and aperiodic states
- Ergodic chains
- Steady-state probabilities
- First passage time
- Absorbing chains
- Steady-state probabilities
- Fundamental matrix
- Markovian decision process
- Model definitions
- Finite time horizon problems
- Queuing theory
- Birth and death processes
- Performance indicators
- Model with one server
- Model with multiple servers
- Decision analysis based on costs

**1. Course number and name**

80267 Processes II

**2. Credits and contact hours**

Credits: 2

Attendance hours: 2 per week

Autonomous work: 4 per week

**3. Text book, title, author, and year**

- Felder, R & Rousseau R., Elementary principles of chemical processes, Third edition, Limusa, 2009.
  - Costa J., Cervera M. S, Cunill G. F, Espugas S., Mans C., Mata J., Chemical Engineering, Introduction to processes, unit operations and transport phenomena, Reverte S.A. 2010.
  - Cengel, Yunus A, Heat and Mass Transfer: A Practical Approach, Third edition, McGraw-Hill, 2007.
- a. other supplemental materials
- Full text articles from “Virtual Pro, Industrial Processes” Journal, [www.revistavirtualpro.com](http://www.revistavirtualpro.com)

**4. Specific course information**

- a. brief description of the content of the course (catalog description).

The subject of Processes II is aimed at students to develop skills such as creative ability, identification and problem solving of industrial process engineering, based on math and science knowledge. In addition, students should be able to integrate and analyze the variables of the different components of a production system to identify improvements in an industrial plant from a technical, economic and environmental point of view.

- b. Prerequisites or co-requisites. 80251 Processes I and 21102 General Chemistry.  
c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required.

**5. Specific goals for the course**

- a. Specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.

Upon completion of the course, students will have the ability to analyze the different technological, economic, and environmental components of a production process, such analysis will be useful in solving problems of industrial process engineering, such as

- Identification of process variables and analysis of unit operations in a production process.
- Production Processes basic design.
- Material balances calculations

- Estimation of the quantities and costs of raw materials required for production.
- Identification of the utilities and equipment for the control of the environmental contamination required for the production.
- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
  - (a) An ability to apply knowledge of mathematics, science, and engineering.
  - (c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
  - (e) An ability to identify, formulate, and solve engineering problems.

#### 6. Brief list of topics to be covered

- Fundamentals concepts of industrial processes
- Process variables, measurements and industrial applications
- Unit systems and conversion factors
- Flow diagrams
- Unit operations: basic concepts
- Unit operations based on mass transfer
- Unit operations based on energy transfer
- Unit operations based on Momentum transfer
- Law of conservation of mass and general equation of mass balance
- Material balances in nonreactive processes: Single process units and multiple process units.
- Material balances for nonreactive systems with recycle, bypass and purge.
- Mechanisms of Heat transfer (conduction, convection, radiation) and Application of heat transfer processes in industry.
- Utilities requirement and Technologies for environmental pollution control.
- Utilities for production (Energy sources, water, electricity and refrigerants).
- Industrial technologies for the disposal of solid, liquid and gas waste from manufacturing plants.
- Analysis of the production process of mass consumption products, related to food, cosmetics, pharmacy, personal care, etc.
- Technology aspects: Process variables and product properties, product conditions for transport and storage, unit operations, flow diagram, overall performance of the process, raw materials quantities, wastes, disposal and treatment.
- Regulatory aspects
- Economic aspects: Demand of the product, national and international market, costs of raw materials, imports and exports.

**1. Course number and name**

801602 Operations Management I

**2. Credits and contact hours**

Credits: 3

Attendance hours: 3 per week

Autonomous work: 6 per week

**3. Text book, title, author, and year**

- Heizer J. and Render, B. Production and Operation Management. Prentice Hall. 2008
- Krajewski L. Ritzman, J. Larry P., and Manoj K. Malhotra. Operations Management: Processes and Value Chains, 8th Edition. Pearson. 2008
- Gil, A.; Domínguez Machuca. Dirección de operaciones aspectos estratégicos en la producción y los servicios. Madrid / McGraw-Hill Interamericana. 1999
- Chase, F. Robert Jacobs, and Nicholas Aquilano. Administración de producción y operaciones. McGraw-Hill. 2005

**4. Specific course information**

- a. brief description of the content of the course (catalog description).  
The purpose of this course is give students the knowledge related to the management of production processes in organizations, giving operations a management approach that contributes to decision making through tools and techniques.
- b. prerequisites or co-requisites. 801502 Study of Work.
- c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required.

**5. Specific goals for the course**

- a. Specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.  
Upon completion of this course, students will be able to:
  - Manage the concepts of Organization and Management related to Planning and Control of Operations.
  - Describe the role of the operations strategy as a source of strength in a competitive global market.
  - Develop operations strategies taking into account the appropriate technology, location and most convenient Plant Distribution
  - Identify and define the characteristics and requirements of the products and / or services.
  - Know the basics and apply the tools for product design.
  - Understand the main characteristics of the configurations and systems of production
  - Perform the planning of the productive capacity of an organization

- Apply forecasting techniques
- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
  - (e) An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics

**6. Brief list of topics to be covered**

- Historical Overview on Operations Management
- Systemic approach of the company
- Operations strategy
- Configurations and production systems
- Product design
- Forecasting methods
- Capacity planning
- Measuring Productivity

**1. Course number and name**

801603 Logistic I

**2. Credits and contact hours**

Credits: 3

Attendance hours: 3 per week

Autonomous work: 6 per week

**3. Text book, title, author, and year**

- Ballou, R H (2004). Logistics, Supply Chain Management. PEARSON
- Frazelle, E (2002). World-class warehousing and material handling. Mc GRAW HILL
- Gómez Saavedra, E (2000). Quality assurance in purchasing: how to develop buyer-supplier relations. RAM EDITORS
- Prawda J (1999). Methods and models of operations research. LIMUSA
- Silver, Pike, Peterson (1998). Inventory management, production, and scheduling. WILEY

a. other supplemental materials

- The World Bank (2016). Connecting to Compete 2016. Trade Logistics in the Global Economy, The Logistics Performance Index and Its Indicators
- DNP- National Planning Department. National Logistics Survey

**4. Specific course information**

a. brief description of the content of the course (catalog description).

The aim of this course is to provide students with the knowledge and tools necessary to understand the elements of a logistics system and how these elements interact towards satisfying customer requirements at minimal cost and service levels required. The course includes historical development of logistics, main decisions in logistics, application of multi-criteria techniques to supplier management and models of inventory management.

b. prerequisites or co-requisites. 80114 Integral Calculus

c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required.

**5. Specific goals for the course**

a. Specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.

Upon completion of this course, students will be able to:

- Search, process and analyze information from various sources and apply knowledge in practice, about logistics.
- Designing systems, components or processes to find desired needs in the supply chain.

- Design and manage systems of reception, handling and storage of materials, parts and products.
  - Design and manage requirements of resources, services and information of the productive system.
  - Propose original solutions to supplier selection problems.
  - Make rational inventory decisions, using inventory models in accordance with the context and in order to minimize the total cost of the system.
- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
- (e) an ability to identify, formulate, and solve engineering problems

#### **6. Brief list of topics to be covered**

- Logistics, historical development of logistics and logistics cycle.
- Supply chains and networks. Main philosophies and trends in logistics
- The decision-making process, main decisions in logistics
- Management of suppliers and purchasing: selection, evaluation and monitoring, application of multi-criteria techniques to supplier management.
- Basic concepts of inventory management.
- Inventory Costs.
- Model of deterministic inventories, inventory costs and EOQ model (economic order quantity)
- Discount inventory model
- Multi-product inventory model.
- Manufacturing inventory model with and without deficit,
- Supply chains- (concept and types), network inventory models.
- Inventory model with variable demand using dynamic programming
- Probabilistic inventory model, perishable product, continuous review, periodic review.
- Conceptualization, characterization of the relations of mutual contribution of the supply chain.
- Coordination, cooperation, collaboration and integration.
- Logistic practices of mutual contribution.
- Practical Development: Beer Game

- 1. Course number and name:**  
21802 Economical Engineering
  
- 2. Credits and contact hours:**  
Credits: 2  
Contact hours: 2  
Individual work hours: 4
  
- 3. Text book, title, author, and year**
  - Bacca Guillermo, 2011, Ingenieria Economica, Bogotá, Panamerican Educational Fund .
  - Anaya Hector, 2012, Final Analysis, Bogotá, Editorial University Externado of Colombia 14 Edition .
  
- 4. Specific course information**
  - a. Brief description of the content of the course (catalog description)  
The purpose of this course is give students the knowledge for understand, develop and apply practical cases in which apply the acquired knowledge on the management of financial mathematics combined with accounting concepts, so that later can integrate in the development of the proposed cases of practical type that allow the decision making.
  - b. Prerequisites or co-requisites: None
  - c. Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required
  
- 5. Specific goals for the course**
  - a. Specific outcomes of instruction,  
With the development of the course the student acquires knowledge regarding interest rate in its different versions. Form of acquisition and cancellation of credits, methods and places of acquisition of such financing; Structure of financial statements (balance sheet, income statement, cash flow), organization, analysis and interpretation of the information provided by these financial statements and the application of indicators. Finally, the organization and application of the cash flows, the use and application of the methods of valuation of Projects and the decision making based on the obtained results.
  - b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
    - (e) An ability to identify, formulate, and solve engineering problems.
    - (h) The broad education necessary to understand the impact of engineering solutions in
  
- 6. Brief list of topics to be covered**
  - Simple interest rate,



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- Types of Discounts, partial payments, value equations.
- Compound interest rate, effective rate, nominal rate, equivalent rate, devaluation, inflation, combined rates, investments in foreign currency.
- Annuities, gradients, amortization, capitalization, cash flow, VPN, IRR, CAUE.

**1. Course number and name:**

62137 English Level 7

**2. Credits and contact hours:**

Credits: 3

Contact hours: 4

Individual work hours: 5

**3. Text book, title, author, and year**

- Dummett, P., Hughes, J., & Stephenson, H. (2013). Life upper intermediate: Andover, Hampshire: National Geographic Learning.  
Gale - National Geographic Virtual Library - Gale. (n.d.). Retrieved from <http://solutions.cengage.com/National-Geographic-Virtual-Library>

**4. Specific course information**

a. Brief description of the content of the course (catalog description)

By the end of level 7, students will demonstrate a solid understanding of written and oral texts related to the relationships and attitudes of people and animals, famous stories (movies and books), appropriate technology around the world, art expressions, development issues in developing countries, and alternative traveling. Similarly, students will produce one written composition in which they analyze and explain problems and propose solutions to diverse problematic situations around the world. Students will talk about varied topics from their own experiences and will propose solutions to worldwide issues. Students will use Information, Communication Technologies (ICT) and learning strategies to become responsible for their own learning.

b. Prerequisites or co-requisites: 62136 English Level 6

c. Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required

**5. Specific goals for the course**

a. Specific outcomes of instruction,

- Speaking. The student can explain problems and propose solutions to current problematic issues around the world.
- Listening. The student can anticipate information to identify specific details in a conversation. The student can understand the main points of clear standard speech and relate the information to their experiences.
- Reading: The student can show understanding of academic texts by explaining and expanding on the topics explored in the suggested texts. The students can discuss, agree and/or disagree with the topics presented in the suggested texts. Furthermore, the student can answer different type of

questions (TRUE/FALSE/NOT GIVEN statement and multiple-choice questions).

- Writing. The student can write accurate and complete topic sentences and paragraphs in a problem-solution essay. The student can use connectors and linking words. Moreover, there is a wide use of appropriate grammar structures.
- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
- g. An ability to communicate effectively

#### **6. Brief list of topics to be covered**

- Topics: Unlikely relationships, immigration, storytelling, overpopulation.
- Vocabulary related to: relationships, family influences, books and films, useful devices, nouns and phrasal verbs, problem-solving expressions.
- Grammar Structures: Mixed present and past tenses as well as future review.
- Topics: Art, graffiti, music and cultural activities, urban-social-sustainable and economic development, alternative travel, staycations, voluntourism, unusual hotels and destinations and couch surfing.
- Vocabulary related to: art, describing likes and dislikes, development nouns and adjectives, problem-solving expressions.
- Grammar Structures: gerunds and infinitives, tag questions

**1. Course number and name**

578005 Core Curriculum Person and Culture V.

**2. Credits and contact hours**

Credits: 3

Attendance hours: 3 per week

Autonomous work: 3 per week

**3. Text book, title, author, and year**

- Hosseini, K. (2003). *Cometas en el cielo*. Salamandra. ISBN: 9788498380729
- Comisión Nacional de Pastoral Familiar. Fundación Jerome Lejeune. *Keys to Bioethics*. Español. JMJ Rio 2013. Brasilia, 2013.
- Congregación para la doctrina de la fe. *Dignitas personae. Sobre algunas cuestiones de Bioética*. 8 de septiembre de 2008. Ediciones Paulinas. 2009.
- López Moratalla, N (2004). *La realidad del embrión humano en los quince primeros días de vida*. En: *Revista Persona y Bioética* vol. 8, núm. 21, enero-abril, pp. 6-23. Citado en: <http://www.redalyc.org/pdf/832/83202102.pdf>
- Lucas Lucas, R. (2005). *Explícame la Bioética. Guía explicativa de los temas más controvertidos sobre la vida humana*. Ediciones Palabra. Madrid,
- Wollstonenecraft Sheelley, M. *Frankenstein*
- Afineevsky, E. (2015). *Winter on fire: Ukraine's fight for freedom*. Netflix.
- Claudel, P. *La nieta del señor Linh*.
- Meseguer, J. (2015). *España: La solidaridad de los muchos pocos*. Aceprensa. Disponible en: <https://www.aceprensa.com/articulos/espana-la-solidaridad-de-los-muchos-pocos/>
- Khadra, Y. *El atentado*.
- Lee, H. y John, D. *La chica de los siete nombres: la historia de una huida de Corea del Norte. The Girl with the Seven Names: a North Korean Defector's Story*
- Rodríguez Luño, Á. (2013). *Ética personal y ética política*. Publicado en [eticapolitica.net](http://eticapolitica.net). Se encuentra online en: <https://www.almudi.org/articulos/8201-etica-personal-y-etica-politica>.
- Sandel, M. (2011). *Justicia ¿hacemos lo que debemos?* Cap. "Justicia y bien común". Barcelona: Debate.
- Alexander, C. *Atrapados en el hielo: la legendaria expedición a la Antártida de Shackleton* /. *The Endurance: Shackleton's Legendary Antarctic Expedition*.
- Hurtado, M. y Pereira-Villa, C. (2011). *Legitimidad empresarial, conflicto de tierras y producción palmera en Colombia*. *Revista Relaciones internacionales estrategia segura* 6(2), 91-110.
- Johnson, C. E. (2011). *Organizational ethics: A practical approach*. Sage Publications. Capítulo 3.
- Narváez D., Getz I., Rest, J.R., Thoma S.J. (1999). *Individual moral judgment and cultural ideologies*.
- Yarce Maya, J. (2016). *Empresas éticas: Un buen negocio* / Jorge Yarce Maya.

- Zollo, L., Pellegrini, M.M., Ciappei, C. What Sparks Ethical Decision Making? The Interplay Between Moral Intuition and Moral Reasoning: Lessons from the Scholastic Doctrine

#### 4. Specific course information

- a. brief description of the content of the course (catalog description).  
The purpose of this course is:
  1. Discover the way of welcoming, caring, respecting, deciding, acting and projecting human life, from conception to natural death, and that of the beings of nature, against the interventions of technoscience.
  2. Understand the moral dimension of your role as a citizen, in the pursuit of the common good.
  3. Understand and internalize a scheme of ethical reasoning to apply in the context of organizations.
- b. prerequisites or co-requisites. 578004 Core Curriculum Person and Culture IV.
- c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required.

#### 5. Specific goals for the course

- a. Upon completion of this course, students will be able to:
  - Develops dialogical skills and interdisciplinary work.
  - Develops a prospective vision in the selection of solutions to bioethical challenges.
  - Strengthens the intellectual habits of synthesis, analysis and constructive criticism.
  - Faces bioethical problems with a secular approach.
  - Discuss bioethical issues in a systematic way that include both local factors and the global context.
  - Recognizes in the humanization of professional performance for the realization of Bioethics and an opportunity to improve as people.
  - Assumes its role as a responsible citizen that contributes to the common good
  - Use the definition of ethics and add the criteria of the six-dimensional model of Hofstede in the formation of ethical minds for decision-making.
  - Identify and understand a method for reasoning in ethical decision-making.
  - It uses the four elements of the theoretical framework to make decisions in a business context and approach the concept of business legitimacy.
- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
  - (f) An understanding of professional and ethical responsibility.

## 6. Brief list of topics to be covered

- Introduction and foundations of Bioethics, forming bioethical minds.
- Bioethics and the beginning of life: Born.
- Bioethics and the care of one's life and solidarity with others: Live
- Bioethical elements of man's relationship with the world around him: Living together
- Bioethical problems at the end of life: Dying
- The common good: the reason of being of the political community.
- The relationship between human nature and political life
- The institutions of the State and of society in the construction of the common good
- State vs market dilemma: subsidiarity and solidarity
- Corruption and service: two sides of political activity.
- When the use of force is justified: just war and resistance against tyranny.
- Ethics, culture and learning to identify ethical considerations in the real context of an organization.
- Ethical reasoning in the decision-making process.
- Development of the decision-making scheme (the ability to interpret that a situation is moral (moral perception).
- Decisions: which path is morally correct (moral judgment).
- Prioritize moral values over others (moral intention).
- Implement moral intention (moral behavior).
- Case study: Recognize, evaluate, decide and reasons to act.

**1. Course number and name:**

801701 Operations Research II

**2. Credits and contact hours:**

Credits: 3

Contact hours: 3

Individual work hours: 6

**3. Text book, title, author, and year**

- Bazaraa, M., Jarvis J., Linear Programming and flow networks, Second edition, Limusa Ed., 1999.
- Kalenatic, D., Network Planning Techniques, fourth edition Fondo Catedráticos. U. DISTRITAL, 2003.
- Hillier, Lieberman, Operations research, Sixth edition Mc Graw Hill, 2001

a. Other supplemental materials

- Project Management Institute. "Project Management Body of Knowledge (PMBOK)." Project Management Institute, 1987.

**4. Specific course information**

a. Brief description of the content of the course (catalog description):

The purpose of the course is to give the student the necessary tools and techniques, so that in his professional practice he can model problems present in the real world as techniques of network planning and thus solve problems of project management and production of goods and services.

b. Prerequisites or co-requisites: 802601 Operation Research I

c. Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required

**5. Specific goals for the course**

a. Specific outcomes of instruction,

This course requires previous knowledge on basic statistics and linear programming. Upon completion of this course, students will be able to:

- Know fundamentals, principles, methods and optimization algorithms to solve problems associated with network theory.
- Know fundamentals, principles, methods and algorithms of optimization to solve problems of project management.
- Know algorithmic optimization algorithm computational tools that allow the treatment of network and project management problems.
- Propose solution alternatives to face complex problems and conceive, describe and specify characteristics of the productive systems of goods or services.

- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
- (e) An ability to identify, formulate, and solve engineering problems.

**6. Brief list of topics to be covered**

- Introduction. General concepts. Beginning. Importance.
- Techniques of planning, programming and control of projects. Structure analysis.
- ADM Networks
- PDM Precedence diagram
- Techniques of planning, programming and control of projects. Analysis of time.
- CPM Critical Path Method.
- PERT Method
- Techniques of planning, programming and control of projects. Cost analysis
- PERT COST method
- Parametric minimization
- Dual Topological
- Techniques of planning, programming and control of projects. Analysis of resources.
- Gantt diagram
- Gray Kidd Algorithm
- Brooks Algorithm



**1. Course number and name:**

801702 Operations Management II

**2. Credits and contact hours:**

Credits: 3

Contact hours: 3

Individual work hours: 6

**3. Text book, title, author, and year:**

- Nahmias, Steven. Production and operations analysis. 2009
- Chase, Richard B. Jacobs, F. Robert; Aquilano, Nicholas J.; Mascaró Sacristán, Pilar; Mauri Hernández, Martha Elsa. Operations management: Production and Supply chain. 2009
- Slack, Nigel; Chambers, Stuart; Harland, Christine; Harrison, Alan; Johnston, Robert; González Osuna, Marcia; Martínez del Campo Varela, Guillermo. Operations Management. México: Compañía Editorial Continental. 1999
- Chapman & Hall. Handbok of Scheduling: Algorithms, Models, and Performance Analysis. Joseph Y-T Leung. 2004
- Handbook of production Scheduling. University of Maryland

**4. Specific course information**

- a. Brief description of the content of the course (catalog description)  
The purpose of this course is to give students the knowledge to develop skills in planning, programming and control of production systems for goods, based on quantitative tools for the decision-making processes in their professional practice.
- b. Prerequisites or co-requisites: 801602 Operations Management I
- c. Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required

**5. Specific goals for the course**

- a. Specific outcomes of instruction,  
Upon completion of this course, students will be able to:  
Analyze production systems based on installed and available capacity and demand forecasts.  
Plan production systems at a strategic, tactical and operational level, through the formulation and solution of mathematical models, the development of MPS and MRP and the programming of tasks under different configurations.
- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
  - (e) An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics
  - (g) An ability to communicate effectively with a range of audiences

(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

**6. Brief list of topics to be covered**

- Introduction to the course
- concepts associated with aggregate planning
- Aggregate planning models
- Simple network aggregate planning model. Bowman Matrix
- Use of software for the simple network aggregate planning model
- Models of mixed strategies with variations in levels of activity and labor force
- Multi-state production planning models
- Material Requirements Planning
- Closed loop Material Requirements Planning
- Construction of Master Production Plan -MPS-, capacities and costs
- Machine scheduling

**1. Course number and name:**

801703 Logistics II

**2. Credits and contact hours:**

Credits: 3

Contact hours: 3

Individual work hours: 6

**3. Text book, title, author, and year**

- Askin R. G. Modelling and analysis of manufacturing. John Wiley & Sons. New York, 1993
- Sule, D.R. Manufacturing facilities: location, planning and design. 3rd Ed. Boca Raton: CRC Press Taylor & Francis Group. 2009
- Ahuja R., Magnati T., Orlin J. Network Flows Theory, Algorithms and applications. Prentice Hall. Upper Saddle River. New Jersey. 1993
- Ballou R. Logística Administración de la cadena de suministro. 5ta. Ed. Pearson Educación de México S.A. de C.V. Naucalpán de Juárez. Edo de México, 2004

a. Other supplemental materials

- Robusté F. Logística de transporte. Ediciones UPC. Universidad Politécnica de Catalunya, 2005
- Journal articles

**4. Specific course information**

a. Brief description of the content of the course (catalog description)

The purpose of this course is to provide students with the skills to identify, to analyze and to evaluate key performance indicators related to logistics systems, such as materials flow, location, transport, information systems, reverse flows, among others, to propose alternatives solutions that meet the economics, environmental and social requirements as a decision-making tool.

b. Prerequisites or co-requisites: 801603 Logistics I

c. Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required

**5. Specific goals for the course**

a. Specific outcomes of instruction,

This course requires previous knowledge on mathematical modelling and optimization. Upon completion of this course, students will be able to:

- Plan and design industrial and services facilities
- Carry out location and layout facilities studies
- Design and manage reception and delivery systems
- Identify social, economic, and environmental issues related to logistics systems

- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
- (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- (i) a recognition of the need for, and an ability to engage in life-long learning
- (j) a knowledge of contemporary issues
- (k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

**6. Brief list of topics to be covered**

- Systems and Logistics Networks.
- Fundamental Concepts
- Logistics Networks
- Graph theory and logistics application
- Modelling and algorithms
- Facilities Location and Layout
- Fundamental concepts
- Euclidian and rectilinear distance
- Single-facility location problem
- Multi-facility location problem
- Facilities Layout
- Modelling and algorithms
- Transport, Logistics and Distribution
- Transport modes and means
- Incoterms and International Commerce
- Routing problems
- Modelling and algorithms
- Reverse logistics

**1. Course number and name:**

801704 Automation and integrated manufacturing systems

**2. Credits and contact hours:**

Credits: 2

Contact hours: 2

Individual work hours: 4

**3. Text book, title, author, and year**

- Serrano, Nicolas., Neumatica Paraninfo Ed., 2009.
- Considine, D.M. Process/ Industrial Instruments and Controls Hand Book. Mc. Graw Hill. 1999.
- Uyemura, John P, Introducción al diseño de sistemas digitales: un enfoque integrado, Paraninfo Ed., 2000

a. Other supplemental materials

- Lajara Rafael. Labview entorno gráfico. Alfaomega. 2007
- Hernandez López Gabriel. Fundamentos y planeación de la manufactura automatizada Un enfoque de los sistemas integrados de manufactura. Pearson. 2015

**4. Specific course information**

a. Brief description of the content of the course (catalog description)

The purpose of this course is give students the knowledge to design, identify and automate processes, students will be able to give new solutions to control and improve productivity.

- b. Prerequisites or co-requisites 801602 Operation management I & 80226 electrotechnical systems.
- c. Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required

**5. Specific goals for the course**

a. Specific outcomes of instruction,

- This course requires previous knowledge on physics and electrotechnical systems.
- Upon completion of this course, students will be able to design new basic automatization systems.
- Automate a process considering the cost

b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

(e) An ability to identify, formulate, and solve engineering problems.

(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

**6. Brief list of topics to be covered**

- Introduction.
- Fundamentals concepts
- Analog and digital signals
- Signals: voltage or current
- Field instrumentation (valves, flow motors, level etc.)
- Sensors Industrial communication
- Digital logic circuits
- Systems
- Electropneumatic systems
- Valves and cylinders
- Combinational systems
- Sequential systems
- Integrated Manufacturing Systems and Industry 4.0.
- Flexible manufacturing systems
- Introduction to LabVIEW and data acquisition cards.

**1. Course number and name:**

21701 Grade Project Seminar

**2. Credits and contact hours:**

Credits: 1

Contact hours: 1

Individual work hours: 2

**3. Text book, title, author, and year**

- Supplementary course material is available at Virtual Sabana -Online system (<http://virtual.unisabana.edu.co/course/view>) for students registered for the course

**4. Specific course information**

- a. Brief description of the content of the course (catalog description)  
The objective of the Seminar Degree Project is to develop the student's critical ability and the ability to solve problems. This objective is fulfilled by the student's identification and treatment of a research problem within the chosen area of study. The course should develop the student's knowledge, understanding, independently plan, and conduct and present a scientific report. In addition, the course should develop the student's ability to critically scrutinize and assess investigations as well as research papers.
- b. Prerequisites or co-requisites: None
- c. Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required

**5. Specific goals for the course**

- a. Specific outcomes of instruction,
  - Identify an analytic review of the relevant literature
  - Identify researchable hypotheses
  - Distinguish between quantitative and qualitative methods
  - Identify the selection of research methods exploring one's research question or hypothesis.
  - Identify the importance of writing process
- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
  - (e) An ability to identify, formulate, and solve engineering problems

**6. Brief list of topics to be covered**

- In this module, students will understand the research cycle and how to generate possible researchable questions. In addition, students will be gaining and understanding of the differences between research and design methods. The

philosophical difference between qualitative and quantitative design will be presented.

- Students will complete the review of the literature and formalize their research questions and hypotheses.
- Students will understand the importance that has writing process as strategy to spread knowledge. Ethics and the use or misuse of research will be presented



**1. Course number and name:**

81119 Financial Management

**2. Credits and contact hours:**

Credits: 4

Contact hours: 4

Individual work hours: 8

**3. Text book, title, author, and year**

- ORTIZ ANAYA, H. Applied Financial Analysis. Universidad Externado de Colombia. 14 edition. Colombia, 2011.
  - RODRÍGUEZ MORALES, L. Analysis of Financial Statements. Editorial Mc Graw Hill. First edition. Mexico, 2012.
  - MACHAIN, L. Simulation of Financial Models. Editorial Alfaomega. First edition. Argentina, 2014.
- a. Other supplemental materials
- SUÁREZ SUÁREZ, A. Optimal investment and financing decisions in the company. Editorial Pyramid. 22 edition. Spain, 2014.
  - BLOCK, HIRT, DANIELSEN. Foundations of financial management. Editorial Mc Graw Hill. 14th edition. USA, 2011.

**4. Specific course information**

- a. Brief description of the content of the course (catalog description)  
The purpose of this course is give students the knowledge for diagnostic the current financial situation of the companies and take decisions align with the corporate strategy.
- b. Prerequisites or co-requisites: 81132 Financial accounting
- c. Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required

**5. Specific goals for the course**

- a. Specific outcomes of instruction,  
Upon completion of this course, students will be able to:
- Use economical and finance tools to formulate models with fundamental variables.
  - Apply techniques and theoretical abilities in economic and finance.
- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
- (h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

**6. Brief list of topics to be covered**

- Trend analyses.

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- Inflation.
- Financial indicators.
- Management of the current assets.
- Financing and decision-making.
- Cash flow.

**1. Course number and name:**

21801 Simulation

**2. Credits and contact hours:**

Credits: 3

Contact hours: 3

Individual work hours: 6

**3. Text book, title, author, and year**

- Banks, J., J. Carson, B. Nelson, D. Nicol, Discrete Event Simulation, Jerry Banks Ed., 2005.
- Kelton, W. Sadowski D., Randall P, Sturrock, D., Simulation with Arena, sixth edition McGraw Hill, 2004.
- Rossetti, M.D., Simulation modeling and Arena, Wiley, 2016.

a. Other supplemental materials

- Law, A. Simulation Modeling and Analysis. McGraw Hill, fifth edition, 2013.
- Full text articles from Winter Simulation Conference, [www.informs-cs.org](http://www.informs-cs.org).

**4. Specific course information**

a. Brief description of the content of the course (catalog description)

The purpose of this course is give students the knowledge of designing and analysis of industrial systems using computer simulation models. The course includes the input analysis, generation of random variables, design and construction of simulation models and experiments, and interpretation of simulation output.

b. Prerequisites or co-requisites: 122304 Probability and Statics I & 801602 Operation Management I.

c. Indicate whether a required, elective, or selected elective course in the program:  
Required

**5. Specific goals for the course**

a. Specific outcomes of instruction,

This course requires previous knowledge on basic statistics and operation management. Upon completion of this course, students will be able to:

- Work on teams
- Model systems with stochastic characteristics
- Design experiments: collect, choose and process data, using statistical tools.
- Apply the steps of a simulation study.
- Build models using specialized software.
- Evaluate alternatives and interpret the statistical analysis results to take decisions.

- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course
- (b) an ability to design and conduct experiments, as well as to analyze and interpret data.
  - (c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
  - (d) an ability to function on multidisciplinary teams
  - (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

#### 6. Brief list of topics to be covered

- Introduction: fundamentals concepts, simulation study, steps and tools, discrete and continuous systems, types of models, steps in a simulation study
- Statistical techniques, simulation languages and software Spreadsheet simulation (Manual simulation).
- Random numbers generation and testing: properties of random numbers, congruential generators, uniform and homogeneity test.
- Random variables: inverse transform technique, composition technique, acceptance-rejection technique
- Input analysis: data collection, identifying probability distributions, goodness-of-fit tests.
- Simulation with Arena: modeling basic operations, detailed operations, entity transfer, modeling resources, shifts, functions hold, batch, separate, etc.
- Statistical analysis of output from terminating simulations: time frame of simulation, confidence intervals for terminating systems, comparing two alternatives.
- Statistical Analysis of simulation output from steady-state simulations: batching in single run, other methods and goals for steady-state statistical analysis, warm-Up and Run Length, truncated Replications.
- The Output Analyzer: evaluating many alternatives with the Process Analyzer (PAN).

**1. Course number and name:**

801801 Statistical Quality Control

**2. Credits and contact hours:**

Credits: 2

Contact hours: 2

Individual work hours: 4

**3. Text book, title, author, and year**

- Montgomery, D.C. Introduction to Statistical Quality Control, 7th edition, John Wiley, 2013.
- Joglekar, A. Industrial Statistics: Practical Methods and Guidance for Improved Performance. 2010. John Wiley & Sons. ISBN 978-0-470-49716-6

a. Other supplemental materials

- Hoerl, R. W., Snee, R.D. Statistical Thinking: Improvement Business Performance, Duxbury, 2002.

**4. Specific course information**

a. Brief description of the content of the course (catalog description)

This course is about the use of basic statistics tools and simple problem-solving methods to improve the quality of the products and services used by our society. Quality improvement methods can be applied to any area within an organization, including manufacturing, process development, engineering design, and the field of services. The purpose of this course is to present the technical tools that are needed to achieve quality improvement in these organizations.

b. Prerequisites or co-requisites: 21402 Probability and Statics II.

c. Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program  
Required

**5. Specific goals for the course**

a. Specific outcomes of instruction,

After successfully completing the course, students should be able to do the following:

- Understand the philosophy and basic concepts of quality improvement.
- Describe the DMAIC process (define, measure, analyze, improve, and control).
- Demonstrate the ability to use the methods of statistical process control.
- Demonstrate the ability to design, use, and interpret control charts for variables.
- Demonstrate the ability to design, use, and interpret control charts for attributes.
- Perform analysis of process capability and measurement system capability.

- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
- (e) An ability to identify, formulate, and solve engineering problems
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

**6. Brief list of topics to be covered**

- Process Improvement and Problem-Solving Strategies.
- Fundamentals of Statistics and Probability.
- Control Charts for Variables.
- Control Charts for Attributes.
- Process Capability Analysis
- Acceptance Sampling for variables.
- Acceptance sampling for attributes.
- Quality Costs and Non Quality Costs

**1. Course number and name:**

801802 Quality and Control Management

**2. Credits and contact hours:**

Credits: 2

Contact hours: 2

Individual work hours: 4

**3. Text book, title, author, and year**

- Quality Management for Organizational Excellence: Introduction to Total Quality. David L. Goetsch and Stanley Davis. 6th edition. Publisher: Prentice Hall, 2014.
- Evans, J.R., Quality and Performance Excellence: Management, Organization and Strategy, Thomson South-Western, 2007.

**a. Other supplemental materials**

- Supplementary course material is available at Virtual Sabana -Online system (<http://virtual.unisabana.edu.co/course/view.php?id=5394>) for students registered for the course
- Morgan, J.M and Liker, J. K., The Toyota Product Development System: integrating people, process and technology, New York: Productivity Press, 2006.
- Liker, J.K., The Toyota way: 14 management principles from the world's greatest manufacturer, New York: McGraw-Hill, 2004.
- Gryna, F. M., Quality planning and analysis: from product development through use, Boston: McGraw-Hill, 2001.

**4. Specific course information**

- a. Brief description of the content of the course (catalog description)  
This course is designed to give students fundamentals of Total Quality Management with emphasis on quality principles, and techniques that have emerged in the Japanese context.
- b. Prerequisites or co-requisites: None
- c. Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required

**5. Specific goals for the course**

- a. Specific outcomes of instruction,  
After successfully completing the course, students should be able to do the following:
  - Identify concepts of quality management and improvement.
  - Develop an understanding of the role of technology, managers, employees, and customers in developing a quality-based workplace.
  - Develop abilities to apply tools and techniques of total quality improvement

- Identify current trends and benchmark organizations related to quality
- Management.
- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
  - (e) an ability to identify, formulate, and solve engineering problems
  - (g) an ability to communicate effectively
  - (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

**6. Brief list of topics to be covered**

- Introduction, total quality concept
- Evolution of quality concepts and quality paradigms
- Quality and global competitiveness.
- Organization for total quality, process management
- Strategic management.
- Quality management.
- Customer satisfaction.
- Leadership and empowerment
- Employee empowerment.
- Quality standards and award models
- ISO 9000/Total Quality.
- Total Quality Management implementation and case studies
- Quality through improvement: Six Sigma, Lean Six Sigma, kaizen, 5S, SPC



**1. Course number and name:**

81123 Fundamentals of Marketing

**2. Credits and contact hours:**

Credits: 3

Contact hours: 4

Individual work hours: 6

**3. Text book, title, author, and year**

- Kotler, P., Armstrong, G. Principles of marketing. 11th Edition. Upper Saddle River, N. J. : Prentice Hall. 2006.
- Kotler, P., Armstrong, G. Marketing principles. 12th Edition. Cambridge: Cambridge University Press. 2008.
- COMPLEMENTARY:
- Staton, W., Walker, B., Etzel, M. Marketing fundamentals. 14 Edition. Mexico: McGraw-Hill Interamericana Publishers. 2004.

**a. Other supplemental materials**

- MOLINÉ, Marçal. THE FORCE OF ADVERTISING. Know how to make good publicity, know how to manage your strength. University Antonio de Nebrija. McGraw Hill. Spain. 2003.
- RIES, Al; TROUT, Jack. POSITIONING: The Battle for Your Mind. McGraw-Hill; 3 edition (December 28, 2000).
- Blackwell, R., Miniard, P., Engel, J. Consumer behavior. 9th Edition. Mexico: Thomson Publishers. 2002.

**4. Specific course information**

a. Brief description of the content of the course (catalog description)

The purpose of this course is give students the knowledge of marketing and its application in any type of organization, maintaining the relationship between the different areas of the company throughout the analysis of customer needs satisfaction.

b. Prerequisites or co-requisites: None

c. Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required

**5. Specific goals for the course**

a. Specific outcomes of instruction,

Upon completion of this course, students will be able to:

- Understand the basic elements of marketing and its implementation in any type of organization by analyzing the needs of the client and the environment
  - Analyze and evaluate the bases for segmentation appropriate to the market segments.
  - Demonstrate critical thinking and analytical skills which provide insight and teamwork skills in an organizational setting.
- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
- (h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

**6. Brief list of topics to be covered**

- Definition of marketing and the marketing process
- Understanding of market and consumers
- Environment Marketing
- Customer Behavior
- Design of a customer-driven strategy and mix: product, price, place, promotion.

**1. Course number and name:**

801802 Occupational Health and Environment

**2. Credits and contact hours:**

Credits: 3

Contact hours: 3

Individual work hours: 4

**3. Text book, title, author, and year**

- Alvaro Jimenez. Apuntes de ecología. Talleres, metodologías de aprendizaje
- J.Gynn Henry , Gary W. Heinke .Ingeniería Ambiental .Segunda edición Person.1999.ISBN 0-13 -120650-8.
- Ernesto C.Enkelsen , Geronimo Cano.Ciencia Ambiental para el desarrollo sostenible Internacional Thomson Editores.-1999. ISBN 968-7529-02.
- Domingo Gomez Orea, Maria Teresa gomez Villarino . Evaluación del impacto ambiental . Tercera Edición :Editorial Muti prensa 2013. ISBN 13: 9788484766438.
- Ernesto C.Enkelsen , Geronimo Cano.Seguridad Industrial Salud .Cuarta edición. Prentice Hall. 2000. ISBN 970-17-03131-6.
- Fernando Henao Robledo .Riesgos físicos I .Ruido Primera edición .Ecoediciones Universidad del Quindío. 2008. ISBN 978-958-648-482-4
- Fernando Henao Robledo.Riesgos físicos II .Iluminación Primera Edición .Ecoediciones Universidad del Quindío. 2007. ISBN 978-958-648-483-1

**a. Other supplemental materials**

- Decreto 1072-2015 Sistema de gestión en seguridad y Salud en el Trabajo
- Norma NTC-ISO 14001-2015 Sistema de gestión ambiental. Requisitos

**4. Specific course information**

**a. Brief description of the content of the course (catalog description)**

The purpose of this course is give students the knowledge for structuring an environmental management system in an organization by identifying the context, planning, implementation and operation, verification and environmental improvement in order to make contributions to sustainable development. On the other hand, this course gives to the student the knowledge to develop an occupational safety and health management system in an organization by establishing policy, planning, implementation, evaluation, audit and improvement actions with the aim of recognizing, evaluating and controlling risks.

**b. Prerequisites or co-requisites: 801502 Work Study**

- c. Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required.

**5. Specific goals for the course**

- a. Specific outcomes of instruction,

Upon completion of this course, students will be able to:

- Structure an environmental management system considering the standard NTC-14001-2015 based on the PHVA cycle
  - Identify methodologies for the prevention of water, soil and air pollution.
  - Identify pollutants in industry, cities and nature.
  - Structure a management system in occupational safety and health based on decree 1072 of 2016.
  - Managing risks related to prevention in safety and health
- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
- (h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
- (j) A knowledge of contemporary issues

**6. Brief list of topics to be covered**

- Measurement and monitoring of environmental performance. Environmental legislation.
- Environmental aspects and impacts Clean production technologies.
- Control of contamination of soil, air, water
- Occupational health and safety management system.
- Management Cycle
- Develop SGS-OS planning Legal requirement.
- Methodology for identification, valuation and control of risk. Risk Matrix
- Work safety program.
- Safety standards, signage and protection elements Health work program.
- Occupational health and hygiene at work Investigation of accidents and diseases
- Legal regulations
- Emergency Prevention, Preparedness and Response Noise Measurement and Lighting.

**1. Course number and name:**

801901 Facilities Planning and Design

**2. Credits and contact hours:**

Credits: 2

Contact hours: 3

Individual work hours: 3

**3. Text book, title, author, and year**

- HENRIQUEZ, Harper. El ABC de las instalaciones de gas, hidráulicas y sanitarias. México: Limusa, 2001.
- HENRIQUEZ, Harper. El ABC de las instalaciones eléctricas industriales. México: Limusa, 2001.
- KONZ, Stepha. Diseño de Instalaciones Industriales. México: Limusa, 2000
- ROSALER, Robert C. - Manual del ingeniero de planta-Tomo I y II - México – Ed. Ofgloma – 1997
- SALDARRIAGA, Juan. Hidráulica de tuberías. Santa fe de Bogotá: Mc. Graw Hill, 1998.
- VILORIA, José Roldán - Manual de mantenimiento de instalaciones – Madrid – Ed. Paraninfo Thomson learning – 2000.

**4. Specific course information**

- a. Brief description of the content of the course (catalog description)  
The purpose of this course is give students the knowledge to design facilities, electrical and hydraulic installations of an industry.
- b. Prerequisites or co-requisites 801703 Logistics II and 80226 electrotechnical systems.
- c. Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required

**5. Specific goals for the course**

- a. Specific outcomes of instruction,  
This course requires previous knowledge on logistics and electrotechnical systems. Upon completion of this course, students will be able to design basic industrial of facilities installation. The students will be able to design a facility considering demand, process, logistic, electric and hydraulic requirements.
- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.  
(c) an ability to design distribution of industrial plants

**6. Brief list of topics to be covered**

- Principles of architectural drawing.
- Facilities and scales.
- Representation of doors, windows and walls.
- Representation of an electrical and hydraulic installation
- Industrial Facilities
- Regional Analysis, Local Choice, Government Influences
- Provision of necessary external services
- Industrial Building
- Draft.
- Premises and areas.
- Typology of distribution.
- Facilities Distribution
- Layout. Analysis of the processes and their relation with the distribution
- Needs of distribution, objectives and benefits.
- Study of the different methods for plant distribution
- Factors affecting distribution.
- Product-Quantity Analysis.
- Determination of method to analyze flow.
- Process diagram of the operation and route.
- The services and their importance in the plant distribution.
- Factors Affecting the Distribution of Industrial Facilities
- Quantitative Methods in the Distribution of Industrial Facilities
- Industrial Services
- Hydraulics
- Electricity

**1. Course number and name:**

21902 Project Engineering

**2. Credits and contact hours:**

Credits: 2

Contact hours: 2

Individual work hours: 4

**3. Text book, title, author, and year**

- Miranda, Juan José, 2012. Project management. MM Publishers.
- Mokate, Karen, 2004. Financial evaluation of investment projects. Uniandes.
- Mokate, Karen, 2003. Economic and social evaluation of investment projects. Uniandes.

**a. Other supplemental materials**

- Serrano, Javier. 2013. FINANCIAL MATHEMATICS AND PROJECT EVALUATION. Uniandes.
- Prieto H., Jorge Eliécer, 2014. Projects: Managerial approach. Ecoe Editions.

**4. Specific course information**

- a. Brief description of the content of the course (catalog description)  
The purpose of this course is give students the criteria for the formulation and evaluation of an engineering project, indispensable during his professional life. These criteria are interdisciplinary, in that, it will value the work in multidisciplinary teams. These criteria including market, process, environment, ethical, and social topics.
- b. Prerequisites or co-requisites: 21802 Economical Engineering
- c. Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required

**5. Specific goals for the course**

a. Specific outcomes of instruction,

Upon completion of this course, students will be able to:

- Recognizes the existence of ethical issues in engineering practice.
- Executes a financial evaluation of an engineering project.
- Recognizes the globalization and its influence on the development of an engineering project.
- Identifies and incorporates into the decision-making process, the potential environmental impacts that may generate an engineering project.
- Identifies and incorporated into the decision-making process the potential social impacts that can generate an engineering project.

- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
- (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- (d) an ability to function on multidisciplinary teams
- (f) An understanding of professional and ethical responsibility.
- (h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

#### 6. Brief list of topics to be covered

- Conceptualization of investment projects:
- Stages of the project.
- Environment of the project.
- Components of a project.
- Definition of the project idea
- Market study
- Analysis of the demand, competition and price for the product or service.
- Commercial strategy.
- Sales projection.
- Technical study
- Definition of the production model, location and size of the project.
- Estimation of costs.
- Administrative study
- Definition of the organizational structure and management model.
- Definition of corporate governance and strategic planning model.
- Environmental and social study
- Environmental impact and mitigation analysis.
- Definition of the social responsibility model.
- Legal study
- Legal framework of a project.
- Legal forms of an organization.
- Financial study
- Structure of a cash flow.
- Financial indicators of a project.



**1. Course number and name:**

21901 Internship Seminar

**2. Credits and contact hours:**

Credits: 1

Contact hours: 2

Individual work hours: 0

**3. Text book, title, author, and year**

- Amaya Rodríguez, L., & Chona Niño, M. C. (2017). Ruta Sabana a la vida profesional. Chía: Editorial Kimpres.

a. Other supplemental materials

- Communication workshops, leadership workshops, Assessment center

**4. Specific course information**

a. Brief description of the content of the course (catalog description)

The purpose of the internship seminar is to provide tools to help students to have a successful approach and adaptation to the professional field. The course covers different topics, that will prepare the student for the transition between academy and a full-time job, related to the preparation of professional internship such as life project, how to make a resume, selection processes, etc.

b. Prerequisites or co-requisites

62137 English level 7

c. Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program

Required

**5. Specific goals for the course**

a. Specific outcomes of instruction,

Upon completion of this course, students will be able to:

- Develop curriculum vitae according to their profile and interests.
- Understand and be able to present and develop each step of a job application process.
- Develop key professional skills to have a successful transition to its internship.

b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

(g) An ability to communicate effectively

(i) A recognition of the need for, and an ability to engage in life-long learning

(j) A knowledge of contemporary issues

**6. Brief list of topics to be covered**

- Internship Seminar introduction
- Internship department presentation
- Objectives of the seminar
- Engineering faculty Internship Regulation
- Key dates: events, due dates, etc.
- Defining professional career path
- Know yourself: strengths and opportunities
- Leadership
- Create consciousness of preferences and values
- Curriculum Vitae
- Sections of a curriculum vitae
- How to design your CV
- Skills identification
- Job application process
- Application process tips
- Job application steps
- Interview
- Psychotechnical tests
- Applied Assessment experience
- Communication skills
- Verbal communication
- Nonverbal communication
- Professional skills
- Team work
- Networking
- Time management
- Emotion management
- Guidelines for internship development
- Workplace safety, security and health
- Employment contract
- Internship project
- Internship outcomes, guidelines and dates

**1. Course number and name:**

802902 Fundamentals of Labor Law

**2. Credits and contact hours:**

Credits: 3

Contact hours: 4

Individual work hours: 5

**3. Text book, title, author, and year**

- Colombian Labor Regime
- Stephen Holmes Cass R. Sunstein, "The Cost of Rights." Twenty first century. 2011.

**a. Other supplemental materials**

- Michael Sandel, "What Money can not Buy". Debate. 2013.

**4. Specific course information**

- a. Brief description of the content of the course (catalog description)  
The purpose of this course is give students the knowledge to interpret the norms established in the Colombian Labor Code from a management perspective.
- b. Prerequisites or co-requisites: None
- c. Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required

**5. Specific goals for the course**

- a. Specific outcomes of instruction,
  - Understand the basic legal concepts related to individual, collective and social security labor law.
  - Write texts with legal content clearly, in labor law issues.
  - Identify the rules that regulate individual, collective labor and social security law, as well as legally relevant relationships in the business field.
- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
  - (h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
  - (j) A knowledge of contemporary issues

**6. Brief list of topics to be covered**

- Introduction to Labor Law. Origins and principles of collective labor law
- Employment contract (suspension and termination), employment relationship, other forms of relationship and employee.

- Remuneration of the Work. Salary.
- Workday.
- Social benefits to be paid by the employer.
- Labor Clearance.
- Social Security.
- Collective Right, classes of trade unions, organs of trade unions, dissolution and liquidation of trade unions, strike in essential public services, union and circumstantial jurisdiction, collective agreements and collective agreements, arbitration court, collective conflict and direct settlement process

**1. Course number and name:**

81111 Human Resources Management

**2. Credits and contact hours:**

Credits: 3

Contact hours: 4

Individual work hours: 5

**3. Text book, title, author, and year**

- NELL Scott and BOHLANDER George. Human Resource Management, Cengage Learning, Sixteenth Edition, Mexico, 2013. Text Guide.
- CHIAVENATO Idalberto. Human Resources Management, McGraw-Hill Publishing, Mexico, 2007.
- RODRIGUEZ Joaquín. Modern Personnel Administration, Editorial Thomsonl, Mexico, 2007.

**a. Other supplemental materials**

- Further reading Obligatory
- Teresa Amabile and Seven Kramer, The Beginning of Progress. Editorial Norma, Bogotá.
- Virtual Sabana (Modle)
- Part of the study material will be worked through the virtual Sabana.

**4. Specific course information**

- a. Brief description of the content of the course (catalog description)  
The purpose of this course is give students the knowledge to identify the importance of human talent management in the current era, analyze the challenges in human talent area in organizations, and understand human talent sub-processes within an organization (linkage, training, performance evaluation, compensation, wellness and retirement)
- b. Prerequisites or co-requisites: None
- c. Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required

**5. Specific goals for the course**

**a. Specific outcomes of instruction,**

Upon completion of this course, students will be able to:

- Identify the roles, responsibilities and importance of a Human Talent area in a company. Define the basic processes of human talent (linkage, training, performance evaluation, remuneration, well-being and retirement plans)
- Identify and understand the labor standards in force in relation to the settlement of wages, benefits and compensation.

- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
- (h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
  - (j) A knowledge of contemporary issues

**6. Brief list of topics to be covered**

- Concept and importance of Human Talent Management
- Challenges in Management of human talent
- Structure of a Human Talent Area and profile of the Human Talent executive
- Occupational analysis and job description
- Staffing processes
- Training processes
- Compensation policies
- Career plan and performance evaluation processes
- Wellness policies
- Retirement plan
- Infrastructure and logistics of Human Talent area

1. **Course number and name**  
211001 Professional Internship
2. **Credits and contact hours**  
Credits: 16  
Attendance hours: 0 per week  
Autonomous work: 40 per week
3. **Text book, title, author, and year:** none
4. **Specific course information**
  - a. Brief description of the content of the course (catalog description).  
Strengthened and implemented acquired knowledge through study classes in a real environment. The idea of this course is that a student can apply: entrepreneurial vision, analysis capacity, teamwork, development of recursion, leadership, solve different types of problems (own and engineering problems)
  - b. Prerequisites or co-requisites. 12939 Internship Seminar
  - c. Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Required.
5. **Specific goals for the course**
  - a. Specific outcomes of instruction.
    - Professional outcomes: analysis capacity, proactivity, ideas generation, identification and solve problem, planification and work organization, team work, leadership.
    - Communication outcomes: Verbal fluency, properly use of different communication channels on the company, good argumentation of different ideas
    - Socio-emotional outcomes: Concern and integration on the work area, ability to work under pressure, tolerance, good information uses, use of different difficulties of labral environment.
  - b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
    - (b) An ability to design and conduct experiments, as well as to analyze and interpret data.
    - (d) An ability to function on multidisciplinary teams.
    - (e) An ability to identify, formulate, and solve engineering problems.
    - (f) An understanding of professional and ethical responsibility.
    - (g) An ability to communicate effectively

- (h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
- (i) A recognition of the need for, and an ability to engage in life-long learning
- (j) A knowledge of contemporary issues
- (k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

**6. Brief list of topics to be covered**

- During the semester, every student must assist to four conferences to cover different topics about the work life, development and strengthened of professional outcomes.
- The student must develop a project in the company, whose goals is improving and optimize a specific area or job in the company.



**1. Course number and name:**

4147CREM Business Creation.

**2. Credits and contact hours:**

Credits: 2

Contact hours: 2

Individual work hours: 4

**3. Text book, title, author, and year**

- Varela Rodrigo V. Desarrollo, Innovación y Cultura Empresarial, Vol I, Entrepreneurship, Universidad Icesi – Centro de Desarrollo del Espíritu Empresarial, 2011, Impresora Feriva S.A., Cali - Colombia.
- Varela Rodrigo V. Innovación Empresarial - Arte y ciencia en la creación de empresas, tercera edición, Pearson Prentice Hall, 2088, 645 pp.
- <http://www.fondoemprender.com/SitePages/Home.aspx>

a. Other supplemental materials

- Metodología para la Implementación de Buenas Prácticas de Formulación Fondo Emprender

**4. Specific course information**

- a. Brief description of the content of the course (catalog description)  
The purpose of this course is give students the knowledge, criteria and methodologies of analysis for understanding business creation projects.
- b. Prerequisites or co-requisites: none
- c. Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Elective

**5. Specific goals for the course**

a. Specific outcomes of instruction,

Upon completion of this course, students will be able to:

- Integrate in a critical and reflexive way the different previous knowledge acquired in his career from the basic sciences, disciplines and research for the development of Basic - Humanistic projects.
- Formulate and evaluate interactive projects in a critical and reflexive way with the environment.

b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

- (i) A recognition of the need for, and an ability to engage in life-long learning

**6. Brief list of topics to be covered**

- Business Process of the Program
- Business Career Vision and definition of commitments.
- Entrepreneurial Spirit.
- Generation and Evaluation of Business Ideas
- Structuring and Evaluation of Business Opportunities,
- Constitution of the Business Plan: methodological development and knowledge of the guide to develop the business plan.
- Constitution of the Business Plan: define objectives, justification and project proponents.
- Constitution of the Business Plan: Carry out the market module
- Constitution of the Business Plan. Perform the operation module.
- Constitution of the Business Plan. Perform the organizational module.
- Constitution of the Business Plan. Perform the finance module
- Constitution of the Business Plan. Carry out the Operational Plan, Impacts and Executive Summary

**1. Course number and name:**

81109 Entrepreneurial Spirit

**2. Credits and contact hours:**

Credits: 2

Contact hours: 2

Individual work hours: 4

**3. Text book, title, author, and year**

- Varela Rodrigo, 2008 "Business Innovation: Art and Science in Business Creation"
- Ponti, Franc. Xavier y Ferrás, Xavier. Passion for Innovation. Group Editorial Norma. 2006.

a. Other supplemental materials

- Wagner, Tony. CREATE INNOVATIVES. Rule. 2012
- Three of Bes. Fernando and Philip Kotler. Innovate to win. The ABCDEF model. Active company. 2011.

**4. Specific course information**

- a. Brief description of the content of the course (catalog description)  
The purpose of this course is to encourage students to develop entrepreneurial, innovative and creative skills and competences that allows them to be applied in the creation and start-up of new companies, ventures of a social or cultural nature
- b. Prerequisites or co-requisites: None
- c. Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Elective

**5. Specific goals for the course**

a. Specific outcomes of instruction,

Upon completion of this course, students will be able to:

- Integrate in a critical and reflexive way the different previous knowledge acquired in his career from the basic sciences, disciplines and research for the development of Basic - Humanistic projects.
- Formulate and evaluate interactive projects in a critical and reflexive way with the environment.

b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

- (i) A recognition of the need for, and an ability to engage in life-long learning

**6. Brief list of topics to be covered**

- General concepts of business, work, family.
- Motivations and incentives by which people move and live.
- The entrepreneurial spirit, innovative and creative.
- Personal and relational Leadership
- Team leadership.
- CASE analysis: Apple, Google, 3M, El Bulli, Cirque du Soleil and others.
- 2 Study of people who have developed a great entrepreneurial or social spirit.

**1. Course number and name:**

3946MAS Environment and Sustainability.

**2. Credits and contact hours:**

Credits: 2

Contact hours: 2

Individual work hours: 4

**3. Text book, title, author, and year**

- Garmendia, A .; Salvador, A .; Crespo, C . ; Garmendia, L. (2005). Environmental Impact Assessment. Madrid. PEARSON EDUCATION S.A.
- Masters, Gilbert M. - Wendell P. She. (2008): Introduction to Environmental Engineering. PEARSON - Prentice Hall.
- Jeffrey Sachs (2015). The Era of Sustainable Development. Paidos COMPANY.

**4. Specific course information**

**a.** Brief description of the content of the course (catalog description)

The purpose of this course is give students the knowledge to review with some level of detail, the Institution, the normative and the procedures in force at national level for the presentation of environmental impact studies and the corresponding environmental management plans when they apply.

**b.** Prerequisites or co-requisites: none

**c.** Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: elective

**5. Specific goals for the course**

**a.** Specific outcomes of instruction,

Upon completion of this course, students will be able to:

- Describe the technical, economic, social and philosophical elements that have determined and must determine the relations of man and human civilization with their natural environment.
- Describe the basic dependency relationships and the physical limits of the terrestrial environment, as well as the current state of these parameters and the consequences for man and society, derived from overcoming them and/or ignoring them.
- Understand that only through the knowledge and objective management of the above factors, it is possible to develop various techniques and tools in all fields of knowledge, to address many aspects of the development of the current human civilization that effectively guarantee the continuity of the species, its present and future development, as well as that of the generations to come.

- Define when a development project, public or private, requires or not for its development, an Environmental Impact Study and its corresponding Environmental Management Plan
- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
  - (i) A recognition of the need for, and an ability to engage in life-long learning

#### **6. Brief list of topics to be covered**

- The numbers and scales of space and the planet.
- The Earth Ecosystem, the Earth Environment, the atmosphere. The biosphere, the hydrosphere, the lithosphere.
- The biosphere and human civilization
- Basic population theory.
- The Dominant Civilization on the Planet.
- History of Human Civilizations.
- Dynamic Systems.
- Use & sustainability. Means. Resilience. Dynamics of growth in a finite world.
- The carbon footprint. The footprint of water. etc.
- Energy and its relation to the planetary environment
- Elements of Environmental Economics.
- Economic growth and circular growth
- Social and environmental ethical principles
- The indicators of environmental sustainability
- Legal and institutional framework in the world and in Colombia.
- Environmental impact studies. Methods of identification of compacts.
- Methods of impact assessment.
- Assessment of environmental elements.
- Environmental management plan.
- Study of cases

**1. Course number and name:**

551404 Financial Mathematics.

**2. Credits and contact hours:**

Credits: 2

Contact hours: 3

Individual work hours: 6

**3. Text book, title, author, and year**

- Economic engineering. Blank Leland- Anthony Tarquin. Fifth edition. Mexico. 2010
- Economic engineering. Baca Currea Guillermo. Eighth Edition. FEP. Bogotá.2007

a. Other supplemental materials

- Investment Decisions for the Financial Valuation of Projects and Companies "- Author: Ignacio Vélez Pareja- Fifth Edition, September 2006- Editorial Pontificia Universidad Javeriana- ISBN: 958-683-896-X

**4. Specific course information**

a. Brief description of the content of the course (catalog description)

The purpose of this course is give students the knowledge to take decisions using interest rates to calculate their profitability, the cost of credits, the calculation of the net present value and the internal rate of return.

b. Prerequisites or co-requisites: None

c. Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Elective

**5. Specific goals for the course**

a. Specific outcomes of instruction,

Upon completion of this course, students will be able to:

- Know and apply the concepts of Simple Interest and Composite.
- Know and apply the technique to calculate and use interest rates, yield or cost, nominal and effective in pesos, UVR or Foreign Currency.
- Manage and calculates through the spreadsheet, the different conversion factors to make the equivalence between different sums of money over time.
- Calculate and apply the Internal Rate of Return (IRR), the Net Present Value (NPV), and the Cost Benefit Ratio (R B / C) in the evaluation of operations and yield of financial assets.
- Appropriately manages and calculates by electronic sheet the different methods and amortization tables of Credits in Colombian pesos, UVR and

foreign currency including the analysis of sensitivity to the modification of the variables involved as: interest rates, number of periods, and changes in quotas to reduce or extend the term among others.

**b.** Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

(i) A recognition of the need for, and an ability to engage in life-long learning

#### **6. Brief list of topics to be covered**

- Cash flow diagrams
- Simple interest rate
- Compound interest rate
- Advance and overdue rates
- Nominal and effective rates
- Equivalent interest rates
- Conversion factors.
- Variable rates: DTF and UVR
- Amortization tables.
- Bonds and investments.
- Methods of evaluation of investment projects.



**1. Course number and name:**

81140 Market Research

**2. Credits and contact hours:**

Credits: 2

Contact hours: 2

Individual work hours: 4

**3. Text book, title, author, and year**

- FRACICA Naranjo Germán. Guide for the design and development of a sampling plan applied to Market Research. Collection class notes. Faculty of Economic and Administrative Sciences. Savannah College.
- HAIR Joseph F, Jr. BUSCH Robert P. ORTINAU David J. Market Research. In a changing information environment. Mc Graw Hill. Second edition.
- KINNEAR Tomas C. TAYLOR James R. Marketing Research. An Applied Approach.

a. Other supplemental materials

- FRACICA Naranjo Germán. Guide for the design and development of a sampling plan applied to Market Research. Collection class notes. Faculty of Economic and Administrative Sciences. Savannah College
- HAIR Joseph F, Jr. BUSCH Robert P. ORTINAU David J. Market Research. In a changing information environment. Mc Graw Hill. Second edition.
- KINNEAR Tomas C. TAYLOR James R. Marketing Research. An Applied Approach

**4. Specific course information**

a. Brief description of the content of the course (catalog description)

The purpose of this course is give students the knowledge to plan, organize, direct and control any market research process that must be carried out in a company.

b. Prerequisites or co-requisites: None

c. Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: Elective

**5. Specific goals for the course**

a. Specific outcomes of instruction,

Upon completion of this course, students will be able to:

- Know the concepts and elements of Market Research.
- Know about the procedures for writing a survey.
- Coordinate qualitative and quantitative studies
- Determine the sample size according to the different sampling methods.

- Must handle a statistical package for Coding, Tabulation and Analysis of Results.
- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
- (i) A recognition of the need for, and an ability to engage in life-long learning

**6. Brief list of topics to be covered**

- The market research process.
- Research process steps.
- Steps in writing a survey.
- Sample design.
- Qualitative research.
- Quantitative research.
- Components of the marketing information system.
- Market research targets related to marketing mix
- Objectives of market research related to the product life cycle.
- Classification of market research.

**1. Course number and name**

1463203 Macroeconomics

**2. Credits and contact hours**

Credits: 3

Attendance hours: 3 per week

Autonomous work: 6 per week

**3. Text book, title, author, and year**

- Nicholson, Walter. Teoría Microeconómica: principios básicos y ampliaciones. Thomson.
- Varian, H. Microeconomía Intermedia. Antoni Bosch Editor – Barcelona.
- Krugman, Paul y Wells, Robin. Introducción a la economía: microeconomía. Editorial Reverté.

**4. Specific course information**

- a. brief description of the content of the course (catalog description).  
Develop both theoretical and practical concepts related to the theory of the consumer and producer focused on the basic concepts of demand and supply, which the student can interpret the decisions of consumers and producers in the process of price formation of an economy.
- b. Prerequisites or co-requisites. None.
- c. indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program: elective.

**5. Specific goals for the course**

- a. This course requires previous knowledge of algebra and trigonometry of high school. Upon completion of this course, students will be able to:
  - Understand the fundamental concepts of consumer theory and apply them to decision making based on consumer preferences, usefulness and restrictions.
  - Understand the fundamental concepts of producer theory and apply them to decision making based on technology, cost structure and producer constraints.
  - Relate the decisions of consumers and producers taking into account the market as a mechanism for allocating resources and the fundamental concepts of producer and consumer theory.
  - Apply the mathematical tools related to decision making for the rational choice of market agents considering market constraints as a mechanism for allocating resources in the consumer economy.
- b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.
  - (i) A recognition of the need for, and an ability to engage in life-long learning

**6. Brief list of topics to be covered**

- Mathematical review
- Algebra, derivation
- Maximization with restrictions
- Functions (maximum and minimum)
- The market
- Demand: displacement factors
- The Offer: displacement factors
- Added demand and offer
- The equilibrium
- Surplus of the producer and consumer
- The elasticities (point method, and average method or arc)
- Public policy and the market
- Taxes
- The subsidies
- Consumer Theory
- Basic concepts, indifference curves
- Theory of preference
- Maximization of utility and choice
- Variation monetary income (Engel curve) and price variation
- Income / Income Effect Analysis and the Substitution Effect
- Theory of the producer
- Basic concepts
- Technology
- Cost functions (short and long term)
- Minimization of costs (short and long term)
- Maximization of benefits (short and long term)