Course name	Course code
Statistical Models	MA 502

Location in curricular map
Common Axis

Course description
This course covers the presentation of probabilistic and statistical models applied to the Engineering disciplines. It includes the theory of probability, random variables, sample distributions, parameter estimation models and hypothesis tests. This course is linked with various subjects of the engineering master's programs, such as: Statistical Models for Quality, Probabilistic Models for Optimization, Advanced Statistical Models and System Simulation, among others.

Course learning outcomes
At the end of this course, the student will: Know, comprehend and apply the theory of probability to problems pertaining to his or her profession. Know, comprehend and apply the most important probability distributions to real life engineering problems. Know and comprehend the different types of sampling, as well as their selection depending on the problem to solve. Know and comprehend the role of joint distributions, random variable transformations and simple distributions in statistical inference. Know and comprehend the Central Limit Theorem and applied it to statistical inference. Formulate, define and solve application problems relating to probability and statistics.

Course Content:	Hours
1. Probability Theory	6
1.1 Axioms and Basic Theorems.	
1.2 Conditional Probability.	
1.3 Event Independence.	
1.4 Multiplication Theorem.	
1.5 Bayes Theorem.	
2. Discrete Random Variables	6
2.1 Classification of random variables.	
2.2 Probability distribution of a discrete random variable.	
2.3 Expected value and variance.	
2.4 Binomial Random Variable.	
2.5 Geometric Random Variable.	
2.6 Pascal Random Variable.	
2.7 Hypergeometric Random Variable.	
2.8 Poisson Random Variable.	
3. Continuous Random Variables	6
3.1 Probability distribution of a continuous random variable.	
3.2 Expected value and variance.	
3.3 Chebyshev Theorem.	
3.4 Uniform Random Variable.	
3.5 Exponential Random Variable.	
3.6 Normal Random Variable.	
4. Introduction to Inferential Statistics	6
4.1 Sampling and types of sampling.	
4.2 Random variable functions.	
4.3 Joint distributions.	
4.4 Random variable transformations.	
5. Sample distributions	6
5.1 Sample distributions related to the normal distribution.	
5.2 Ji-square distribution.	
5.3 t Student distribution.	
5.4 F distribution.	
5.5 Central Limit Theorem.	
6. Estimation and hypothesis tests.	6

6.1 Point estimation. 6.2 Trust intervals estimation. 6.3 Sample size. 6.4 Elements of an hypothesis test. 6.5 Hypothesis tests for large samples. 6.6 Hypothesis test for small samples. 6.7 Variance hypothesis tests.	

Learning activities guided by professor	**Hours** **36**
1. Thematic exposition by professor	20
2. Laboratory and/or workshop activities guided by professor	OP
3. Presentation plenary and/or discussions moderated by professor	12
4. Small group activities guided by professor	4
5. Individual activities guided by professor	OP

Independent learning activities:	Hours 60
1. Reading of materials selected by professor. a. Student must read individual materials from the course, selected by the professor, to discuss in class.	20
2. Writing of articles, essays or reading summaries. a. The student must write an essay where he or she explains the procedure for an hypothesis tests in a real life situation of his or her professional activity.	5
3. Solving of problems selected by professor. a. The student must complete 5 homework tasks during the course. These homework tasks consist of application problems from concepts worked in class and will be from the course Bibliography.	20
4. Integral course project. a. Consists of a final project that integrates the knowledge acquired during the course to a real situation. The project may be elaborated in teams of 4 or 5 persons.	15

Evaluation procedures and instruments:

The evaluation instruments and procedures for this course are listed below.

1. Oral or written exam.
    - The student must demonstrate in an oral or written manner, that he or she knows, comprehends and applies the principles pertaining to the course.
2. Deliverables.
    a. The student must write an essay where he or she explains the procedure for an hypothesis tests in a real life situation of his or her professional activity.
    b. The student must deliver 5 homework tasks during the course.
    c. The student must deliver a final project that integrates the knowledge pertaining to the course in a real situation.
3. Group presentations.
    - The student will be involved in the presentation of the course content.
4. Participation in discussion sessions.
    - This will not be evaluated.

Evaluation criteria:

1. The evaluation instruments and procedures will be centered in the learning activities, either guided or not guided by the professor.
2. The professor will evaluate and assign a grade in each of the evaluation instruments. The awarded grade will be between 0 and 100.
    a. Essay 10 points.
    b. Class presentations 10 points (bonus).
    c. Written exams 35 points.
    d. Homework tasks 30 points.
    e. Research and presentation of a subject 25 points.
3. The professor will report to the Graduate College the average grade obtained by the students in all the evaluation instruments.
4. The minimum passing grade for the course is 80.
5. A student may not obtain a failing grade due to accumulated non-attendance.

Bibliography

	Type	Title	Author	Publisher	Year
	Text	Applied Probability and Statistics for Engineering	Montgomery y Runger	McGraw Hill	1996
	Ref.	Mathematical Statistics with Applications	Mendenhall-Scheaffer-Wackerly.	Thomson	2002
	Ref.	Probability and Statistics for Engineering and Sciences	Jay L. Devore.	Thomson	1998
	Ref.	Mathematical Modeling Class Notes	Alfredo Rodríguez Carrasco.		

Course name	Course code
Project Management	AD 509

Location in curricular map
Common Axis

Course description
In this course the student will develop pan integral vision of Project Management, it's areas of knowledge, as well as its relation to other disciplines. During the course the student will develop abilities that allow him or her to plan and organize a project, manage the time and resources necessary to complete the project, determine the necessary organizational structure, as well as human implications. The student will apply cost estimation, budget control, financial and risk evaluation; in general the student will be able to evaluate the development and performance of the project. During the course, the student will develop a project where professional practices must be applied, essential to project development, such as negotiation, working with virtual teams, conflict solving, and executive communications and presentations. As a tool for project management and follow up, the student will use MS Project software. The course will provide knowledge and abilities that have application in all fields of human and professional activity, that will also be put into practice in other courses of the master's program.

Course learning outcomes
At the end of this course, the student will: • Be able to plan, manage, execute and evaluate a project that includes participation of many people, different professional disciplines, in public, service or industrial organizations. • Apply criteria for the selection of projects. • Know, comprehend and use planning and organizing techniques for projects. • Use specialized software for project management, applying techniques and tools for project programming. • Design monitoring and control systems for projects. • Determine the organizational and team structures that are most appropriate to fulfill the project according to the organizational environment. • Identify human abilities for projects and their development. • Analyze costs and budgets for the financial evaluation of a project.

Course Content:	Hours
1. Projects in contemporary organizations	8

1.1. Project start up 1.2. Project selection 1.3. Profile of the project leader 1.4. Types of organizations for projects 1.5. Project planning	
2. Project implementation 2.1. Costs and budgets 2.2. Programming 2.3. Resource assignment 2.4. Information systems and monitoring 2.5. Project control	16
3. Leadership for projects 3.1. Conflicts and negotiation 3.2. Management and development of teams	8
4. Project conclusion and integral analysis of subjects	4

Learning activities guided by professor	**Hours** **36**
1. Thematic exposition by professor	16
2. Analysis and discussion of cases and examples	8
3. Presentation plenary and/or discussions moderated by professor	4
4. Application of MS Project software to specific situations	8
5. Exercises and small group activities guided by professor	OP
6. Individual activities guided by professor	OP

Independent learning activities:	Hours 60
1. Reading of materials selected by professor. a. Reading of articles and book chapters to identify the disciplines related to Project Management. b. Reading of articles and book chapters to understand the concept of Project Management in contemporary organizations. c. Reading of articles and book chapters to know and understand project start up. d. Reading of articles and book chapters to know and understand project implementation. e. Reading of articles and book chapters to understand project conclusion.	10
2. Writing of articles, essays or reading summaries. a. An executive summary of each of the assigned reading materials.	10
3. Solving of problems selected by professor. a. A financial evaluation exercise for a Project.	12
4. Field practice. a. This activity will not be done in this course..	
5. Research of a subject assigned by the professor. a. A research report to find current articles from renowned and specialized sources that deal with the application of project management under a high performance focus.	8
6. Integral course project. a. The student will develop pan integral course project, the status of which must be presented periodically to the professor. The project will consist of selecting an developing a project related to his or her organization. MS Project will be used or a similar software to present the programming of activities and demonstrate the way the project is supervised. The professor will give instructions regarding the work in the sense that it must present evidence that the student is applying the knowledge covered in each of the course subjects.	20

Evaluation procedures and instruments:

The evaluation instruments and procedures for this course are listed below.

Oral or written exam.

The student must demonstrate in a written form that he or she understands and comprehends the subjects covered throughout the course.

Deliverables.

Brief summaries of reading materials.

Report of a financial evaluation exercise for a project.

Research report.

The student must deliver a status report of each of the stages of the integral course project, as well as a final report of the project that demonstrates the use of specialized software.

Group presentations.

The student must present to the professor and the group the integral course project, the obtained results, as well as the primary obstacles encountered in the implementation, and the proposed way to solve them.

Participation in discussion sessions.

It is expected that students actively participate in all class sessions; this implies previous reading and valuable contributions to discussions of cases and examples.

Evaluation criteria:

1. The evaluation instruments and procedures will be centered in the learning activities, either guided or not guided by the professor.
2. The professor will evaluate each of the evaluation instruments and assign a grade. The awarded grade must be between 0 and 100.
    a. Oral or written exam 25 points.
    b. Integral course project 75 points.
3. The professor will report to the Graduate College the average grade obtained by the students in all the evaluation instruments.
4. The minimum passing grade for the course is 80.
5. A student may not obtain a failing grade due to accumulated non-attendance.

Bibliography

	Type	Title	Author	Publisher	Year
	Text	Project management: A managerial approach	Jack R. R. Meredith, Samuel J. Mantel, George Francis Pinder, Samuel J. Jr. Mantel	Wiley, John & Sons	2002
	Software	Microsoft® Project® for Windows®	Microsoft Corporation		2002
	Text	A Guide to the Project Management Body of Knowledge: PMBOK Guide	Project Management Institute	PMI	2001

Course name	Course code
Strategy and competitiveness	AD 510

Location in curricular map
Common Axis

Course description
The student will comprehend and integrate the elements or components that intervene in the design, formulation and implementation of a business strategy. In particular, the student will understand the current concepts relating to strategic management that impact an organization, such as: global competition, markets, technology, process development and organizational integration. Once the business strategy possibilities and current concepts that influence the organization are understood, the student will define the best strategy according to established plans, via the strategic management process. The student will apply to real life situations, the strategic management process with the purpose of achieving a competitive level in the organization and sustainable development.

Course learning outcomes

At the end of this course, the student will:

- Comprehend and integrate the elements and components that are required for the formulation of a business strategy.
- Comprehend and integrate the basic concepts of strategic management; competition, market, technology, process and business integration.
- Design a business strategy to achieve competitiveness under different situations and markets.

Course Content:	Hours
1. Competitiveness and the Strategic Management Process 1.1. Basic definitions 1.2. The challenge of strategic managament 1.3. The competitive field of the XXI century 1.4. The Strategic Management Process	3
2. External Environment 2.1. Analysis of the external environment 2.2. Segments of the external environment 2.3. Analysis of the industrial sector environment 2.4. Analysis of the competition	3
3 Internal Environment 3.1 Analysis of the internal environment 3.2 Resources 3.3 Capacities 3.4 Central competencies	3
4 Business Level Strategies 4.1 The clients. Who, What and How 4.2 Types of business level strategies 4.3 Cost leadership 4.4 Differentiation	4 5
5 Competitive Dynamic 5.1 Increment in rivalry in the new competitive field 5.2 Dynamic competition and rivalry model 5.3 Attack possibilities 5.4 Capacity for decision making and response	
6 Corporate Level Strategies 6.1 Diversification levels 6.2 Reasons for diversification 6.3 Related and non related diversification 6.4 Management motivation for diversification	3
7 Acquisition and restructuring strategies 7.1 Increase in fusions and acquisitions 7.2 Effective acquisitions 7.3 Restructuring	3
8 International strategies 8.1 Identifying international strategies 8.2 International strategies 8.3 Environmental tendencies 8.4 Risks in an international environment	3
9 Cooperative strategies 9.1 Types of cooperative strategies 9.2 Business level cooperative strategies	3

9.3 Corporate level cooperative strategies 9.4 International corporate strategies	
10 Organizational structure and controls 10.1 Evolution of organizational structures 10.2 Implanting business level strategies 10.3 Implementing corporate level strategies 10.4 The effect of structure in strategy	3
11 Strategic leadership 11.1 Managers as an organizational resource 11.2 Determining the strategic direction 11.3 Exploiting and maintaining central competencies 11.4 Developing human capital and organizational structure	3

Learning activities guided by professor	**Hours** **36**
1. Thematic exposition by professor	12
2. Application resolution workshop guided by the professor	12
3. Presentation plenary and/or discussions moderated by professor	4
4. Small group activities guided by the professor	4
5. Individual activities guided by professor	4

Independent learning activities:	Hours 60
1. Reading of materials selected by professor. a. Individual Reading materials to know and comprehend the fundamental concepts indicated in the syllabi. b. Application cases that will be discussed in class. Cases from the text book and other texts will be used.	10
2. Writing of articles, essays or reading summaries. a. Writing of summaries from the subjects indicated in the syllabi, and also from discussion questions from each of the chapters studied, and which will serve as material for discussion panels in class.	10
3. Solving of problems selected by professor. a. The student must suggest the strategy that he or she considers most convenient for each case. The proposal must be made based on the case analysis methodology for strategic management seen in class.	10
4. Field practice. a. The student most independently do the exercises from the guided workshop and make small variants of these. The workshop is based on text book chapters and other texts. The student must justify the proposed strategy based on the strategic management reference. Research from internet and other sources will be done.	10
5. Research and development of a case. a. The student must elaborate a case based on observation done in teams based on a real life situation or company, and present the case to the group.	10
6. Final course integrating project. a. This is a mandatory activity and worked in teams of 2 or 3 students. The Project must implement the strategic management methodology worked in class to a situation relating to his or her professional activity.	10

Evaluation procedures and instruments:

1. **Homework reports and reading summaries (20%)** Each task, homework or report indicated by the professor, be it a reading summary, written answers, etc, must contain the following:

   Name and student number, homework number and brief description or name of homework (it is the student's obligation to keep track of homework numbers and descriptions), date of delivery (according to date established in class), late homework will not be accepted.

   Some homework must be done individually and other homework must be done in teams. The ability and clarity that the student manifests in his or her presentations will be evaluated. The lack of any of the indicated information will incur in a cancelation of the homework without the opportunity to deliver it at a later date.

2. **Partial examinations (20%)** Three partial examinations will be done in dates established in the course syllabi. exams will not be administered outside established dates.

3. **Presentations of chapters or cases and participation in class (10%)** Proactive participation in class and in previously assigned presentations will be evaluated. The commitment of each student towards the achievement of the unit learning outcomes as well as the general course outcomes will also be evaluated. The creativity shown by the student in the realization of learning activities, either oral or written as well as the disposition to work in teams will be evaluated as well. Last but not least, punctuality in attendance and any other class commitment will be of high importance for evaluation not only in this aspect but in all aspects of the course.

4. **Case reports or partial cases (30%)** According to the syllabi, case reports for cases assigned by the professor in class.

5. **Discussion questions (20%)** True or false pop quizzes in English will be administered by the professor, and these will be based on the discussion questions at the end of text book chapters. The discussion questions and quizzes seek to promote self evaluation by the student relating to the subjects being studied.

Evaluation criteria:

1. The evaluation instruments and procedures will be centered in the learning activities, either guided or not guided by the professor.
2. The professor will evaluate and assign a grade for each of the instruments previously indicated.

3. The professor will report to the Graduate College the average grade of all the evaluation instruments, for each student, in a scale from 0 to 100.
4. The minimum passing grade for the course is 80.
5. A student may not obtain a failing grade due to accumulated non-attendance.

Bibliography

Text

Hitt Michael A., Ireland R. Duane and Hoskisson Robert E. "Strategic Management: Competitiveness and Globalization", South-Western College Publishing, Forth Edition, 2001, U.S.A.

Other texts

1. Ansoff Igor and McDonnell Edward, "Implanting Strategic Management", Prentice Hall, Second Edition, Great Britain.
2. Hax Arnoldo C. "The Strategy Concept and Process", Second Edition, Prentice Hall, U.S.A. 1996.
3. David Fred R. "Strategic Management", Sixth Edition, Prentice Hall, 1997, U.S.A.
4. Barney Jay B. "Gaining and Sustaining Competitive Advantage", Addison-Wesley Publishing Company, 1997, U.S.A.

Course name	Course code
Decision Making Support Systems	SI 507

Location in curricular map
Common Axis

Course description
The first part of this course deals with the importance of information systems in the decision making process. The second part of this course deals with the models, concepts and technology used in the design of Decision Making Support Systems. Lastly, the third part of the course deals with Decision Making Support Systems in corporate environments (companies and work groups).

Course learning outcomes
At the end of this course, the student will: Know and comprehend the decision making process, as well as its implications for problem solving. Know and comprehend the various information systems that support management. Know and comprehend a special type of information system known as "Decision Making Support System". Design and implement a decision making support system prototype. Design and implement a data base prototype using a decision making support system. Know and comprehend the various information systems that support group decisions and, especially, the type known as "Executive Information System". Know the primary tendencies in information systems, either with regards to designo or implementation technologies.

Course Content:	Hours
1. Decision making and computerized support	8
1.1 Management support systems.	
1.2 The decision making process.	
1.3 Systems, modeling and support.	
2. Decision Making Support Systems	16
2.1 Overview of a Decision Making Support System	
2.2 Data base design	
2.3 Decision model design	
2.4 Knowledge base design	
2.5 User interface design	
2.6 Development of a Decision Making Support System	
3. Group Decision Making Support Systems	8
3.1 Network systems	
3.2 Group Decision Making Support Systems	
3.3 Executive information systems	
4. Tendencies of Decision Making Support Systems	4
4.1 Corporate intelligence	
4.2 Data mining	
4.3 Intelligent Business Systems	

Learning activities guided by professor	Hours 36
1. Thematic exposition by professor	20
2. Laboratory and/or workshop activities guided by professor	12
3. Presentation plenary and/or discussions moderated by professor	4
4. Small group activities guided by professor	OP
5. Individual activities guided by professor	OP

Independent learning activities:	**Hours** **60**
1. Reading of materials selected by professor. • Reading of articles and chapters to know and comprehend Decision Making Support Systems and the design process. Specifically, chapters 1,2 of the E. Turban text. • Reading of individual Reading materials to know and comprehend information systems in network and corporate environments. Specifically, chapters 9, 10 and 11 of the E. Turban text.	10
2. Writing of articles, essays or reading summaries. • The student must write a technical article where the decision making problem in a corporate environment is described, and the way to implement an information system to solve said problem.	5
3. Solving of problems selected by professor. • The student must solve the chapter 1 case study. • The student must solve exercises 1,2,3 and 4 of chapter 4. • The student must solve exercises 1 and 2 of chapter 3..	10
4. Field practice. • In this activity, the student must develop abilities to use software tools for the design of information systems, and will be optional and according to the students necessities.	OP
5. Research of a particular subject assigned by the professor. • The student must present a particular subject selected from chapters 4,5,6 and 7 of the text book.	10
6. Integral course project. • For this activity, the student must develop exercises 1,2 and 3 of chapter 8 and develop a computational tool prototype.	25

Evaluation procedures and instruments:

The evaluation instruments and procedures for this course are listed below.

- Oral or written exam.
    - The student must prove understanding and comprehension of the subjects relating to the course in an oral or written manner.
- Deliverables.
    - The student must deliver a technical article that presents a decision making problem that must be solved with the technology seen through the course and also explain how it is to be used.
    - The student must deliver a report and the exercises done to solve each of the text book problems assigned by the professor.
- Group presentations.
    - The students must present an integral course project at the date and hour established by the professor in accordance with the group.
- Participation in discussion sessions.
    - This will not be evaluated.

Evaluation criteria:

The evaluation instruments and procedures will be centered in the learning activities, either guided or not guided by the professor.

The professor will evaluate each of the evaluation instruments and assign a grade. The awarded grade must be between 0 and 100.

Technical article 25 points.

Problem and case solving 25 points.

Research and presentation of particular subject 15 points.

Integral course project 35 points.

The professor will report to the Graduate College the average grade obtained by the students in all the evaluation instruments.

The minimum passing grade for the course is 80.

A student may not obtain a failing grade due to accumulated non-attendance.

Bibliography

	Type	Title	Author	Publisher	Year
	Text	Decision Support Systems and Intelligent Systems	Efraim Turban	Prentice Hall. USA	1998
	Ref.	Decision Support Systems and Intelligent Systems, 2E.	Daniel Cohen	McGraw Hill	1998

Course name	Course code
Process Analysis and Improvement	II 517

Location in curricular map
Common Axis

Course description
Throughout the course, the student will be involved in the analysis and presentation o diverse methodologies used in the improvement of processes, such as: Strategic Management, Total Quality Management, Process Re-engineering, Restriction Theory and Manufacturing Integration. Learning activities that will be used are reading, presentations and concept discussions, analysis of successful case studies, as well as a final project that may be done individually or in teams which uses one or more of the studied techniques to a real life system.

Course learning outcomes
At the end of this course, the student will: Develop a conceptual reference frame for the improvement and optimization of processes and systems of human activity and identify the methodologies, techniques and models that are the most adequate to improve the performance of a system or a process in particular.

Course Content:	**Hours** **Tema**
1. Introduction to system improvement. 1.1 Basic fundamentals of systems and optimization 1.2 Generic functions of an organization dedicated to goods and services. 1.3 Strategic management 1.4 Strategic planning	6
2. Total quality management and related techniques. 2.1 Continuous improvement philosophy 2.2 Productivity through process analysis 2.2 Just in time and beyond 2.3 Statistical process control objectives 2.4 Experiment design objectives 2.5 Problem solving techniques	10
3. Process re-engineering and other methodologies. 3.1 Fundamentals of process re-engineering 3.2 Identification of critical processes and ICAM methodology 3.3 Restriction theory 3.4 Manufacturing integration 3.5 Concurrent engineering	10
4. Process improvement. 4.1 Process improvement in the company. 4.2 Process mapping. 4.3 The visual company 4.4 Added value management. 4.5 Lean Manufacturing. 4.6 Six Sigma	10

Learning activities guided by professor	**Hours** **36**
1. Thematic exposition by professor	20
2. Laboratory and/or workshop activities guided by professor	12
3. Presentation plenary and/or discussions moderated by professor	4
4. Small group activities guided by professor	OP
5. Individual activities guided by professor	OP

Independent learning activities:	**Hours 60**
• Reading of materials selected by professor. • Writing of articles, essays or reading summaries. • Solving of problems selected by professor. • Research of a subject assigned by the professor. • Integral course project.	20 10 10 10 10

Evaluation procedures and instruments:

The evaluation instruments and procedures for this course are listed below.

- Oral or written exam.
  - The student must prove that he or she understands and comprehends the primary subjects of the course either in a written or oral form.
- Deliverables.
  - The student must deliver a technical article where he or she presents a decisions problem that may be solved using the techniques studied throughout the course, and explain in detail how they will be used.
  - The student will deliver a report, and exercises done to solve each of the problems from the text book assigned by the professor.
- Group presentations.
  - All students must present an integral course project at the date and hour defined by the professor in accordance with the group.
- Participation in discussion sessions.
  - This will not be evaluated.

Evaluation criteria:

The evaluation instruments and procedures will be centered in the learning activities, either guided or not guided by the professor.

The professor will evaluate each of the evaluation instruments and assign a grade. The awarded grade must be between 0 and 100.

Technical article 25 points.

Problem and case solutions 25 points.

Research of presentation of a course subject 15 points.

Integral course project 35 points.

The professor will report to the Graduate College the average grade obtained by the students in all the evaluation instruments.

The minimum passing grade for the course is 80.

A student may not obtain a failing grade due to accumulated non-attendance.

Bibliography

	Type	Title	Author	Publisher	Year
	TEXT	Process Improvement	Harrington. H.J.	MacGraw-Hill	2000
	REF	Strategic Management	Thompson & Strickland,	Irwin, Boston	1992
	REF	The Next Phase of Total Quality Management	Robert E. Stein	Dekker, New York	1994
	REF	Business Process Reengineering	Johansson, Mchugh, Pendlebury, Wheeler III	Wiley, New York,	1993
	REF	Reengineering The Corporation	Hammer, Champy	Harper Business, New York	
	REF	Automation Production Systems, and Computer Integrated Manufacturing	Mikell P. Groover,	Prentice Hall, New Jersey	1987

Course name:	**Course code:**
Research methodology	CS 502

Location in curricular map:
Common Axis

Course description:

The course will provide the necessary tools to develop the general research process, with a specific orientation towards the development of an application project.

Course learning outcomes:
The student sill know the stages that comprise the general research process, from the selection of a subject to the publication of results. At the end of the course, it is expected that the student conclude the elaboration of his or her research protocol.

Course Content

1. Problem definition
- 1.1 Criteria for the definition of a research problem
- 1.2 Elements of problem definition

2. **Theoretical reference elaboration**
- 2.1 Functions of theoretical reference
- 2.2 How to construct theoretical reference

3. Hypothesis formulation
- 3.1 Variables
- 3.2 Relationship between hypothesis, questions and research objectives.

4. Sample selection
- 4.1 Types of samples
- 4.2 Selection procedure

5. **Data gathering and analysis**
- 5.1 Data gathering instruments
- 5.2 Statistical analysis

6. Research report elaboration
- 6.1 Receptor or user
- 6.2 Research report elements

Learning activities:

- **Guided classroom activities:**
  - Presentation of subject by the professor
  - Group discussion
- **Independent activities:**
  - Previous readings
  - Research work

Evaluation criteria and procedures:

- Written delivery and oral presentation of the first proposal of thesis (Title, justification, general and specific objectives, materials and methods).
- Participation

	Type	Title	Author	Publisher	Year
1	Reference text	Research methodology	Roberto Hernández Sampieri	McGraw Hill	1991
2	Reference text	Thesis elaboration manual	Berenice Ibáñez Brambila	Trillas	1997

Course name:	**Course code:**
Application Project	CS 501

Location in curricular map:
Terminal Axis

Course description:

Throughout the course, the student will develop pan application project that demonstrates the capacity for analysis, team work, interpretation and application of knowledge and tools acquired throughout the masters program

Course learning outcomes:
The student will be capable of applying the knowledge and abilities acquired throughout the courses of the masters program, contributing to the development of practical solutions that benefit the community.

Course Content	**Hours**
1. Definition of application pre-project.	**16**
2. Ethics in professional services.	**4**
3. Project presentation.	**4**
4. Follow up by professor.	**4**
5. Presentation of pre results.	**4**
6. **Presentation of final results.**	**4**

Learning activities:

- **Guided activities:** **36**
  - Presentation of subject by professor.
  - Presentation by guest researchers.
  - Discussions of subjects and cases.
  - Final project presentation.
- **Independent activities:** **60**
  - Applied research case reading.
  - Information gathering.
  - Research reports.
  - Problem analysis.
  - Solution design.

Evaluation criteria and procedures:
The evaluation instruments are the following: Homework and research work Final project research Participation The points distribution for each instrument will be established in accordance with the group in the first class session.

Bibliography

	Type	Title	Author	Publisher	Year
1	None				