Course name:	**Course code:**
Total Quality Management	II 510

Location in curricular map:
Specialization Axis

Course description:
During this course, the student will study various concepts and principles related to quality management, with the purpose of generating a conceptual framework for a total quality management model, and offer proposals for the management of these in manufacturing and service organizations. The course covers processes for quality management from client needs detection to post-sale service, and also, the use and application of some of the models used in said processes. Student will learn fundamental concepts and models of quality management, via a combination of reading, class participation, case studies, as well as other individual and group assignments. Students will work in a team environment, and practice their verbal, written and graphic communication skills to discuss and present information relating to the concepts studied throughout the course.

Course learning outcomes:
At the end of the course, the student will: • Comprehend the various elements, systems, programs and techniques that integrate a quality management system, as a strategy to achieve productivity and competitiveness in manufacturing and service organizations. • Identify client desired product characteristics using adequate methodologies, and evaluate the implications of putting them into effect from the competitiveness perspective of the organization. • Design a total quality management model for an organization.

Course content:	Hours
1. Introduction to quality systems. 1.1 Quality background. 1.2 Fundamental concepts. 1.3 Quality planning, control and improvement. 1.4 Quality, productivity and competitive advantage.	4
2. Evaluation of quality in an organization. 2.1 The importance of evaluation. 2.2 Quality costs. 2.3 Market position. 2.4 Culture of quality in the organization.	4
3. Study of client needs. 3.1 Identifying the client. 3.2 Determining client needs. 3.3 Information sources of market quality.	8
4. Total quality management. 4.1 Introduction. 4.2 Elements and principles of total quality. 4.3 The role of upper management: leadership. 4.4 Strategic planning 4.5 Resource, process and information management. 4.6 Quality philosophies. 4.7 Total quality models.	20

Learning activities guided by professor:	**Hours** **36**
1. Thematic exposition by professor	20
2. Laboratory practices and/or workshops guided by professor	OP
3. Presentation and/or discussion plenary guided by professor	6
4. Small group activities guided by professor	6
5. Individual activities guided by professor	4

Independent learning activities:	Hours 60
1. Reading of materials selected by professor.	
• The student must do individual reading to know and apply the principles total quality management.	20
2. Solving of case studies and problems selected by professor.	
• The student must solve case studies and problems assigned by the professor from the course bibliography.	10
3. Research and development of a topic selected by the professor.	
• This activity consist of researching various elements relating to a quality system.	10
4. Writing of an article.	
• The student must write an article where he or she suggests a quality management model.	10
5. Integral course project.	
• The student will elaborate and present at the end of the course a final project related to the topics covered throughout the course. The objective of this project is the proposal of a total quality management model.	10

Evaluation procedures and instruments:

The evaluation procedures and instruments are the following:

1. Written exam.
    - The student must prove to the professor via a written exam, the knowledge of the primary course topics.
2. Deliverables.
    - The student will deliver a report of the solutions for each of the case studies selected for each course unit.
    - The student will deliver a report of the research works assigned by the professor.
3. Presentations.
    - All students must present their final project to the group, on the day and hour that is established by the group and professor.
4. Participation in discussion sessions.
    - Students must participate in discussions of course content.

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

	Type	Title	Author	Publisher	Year
	Text	Quality control and management	James R. Evans William Lindsay	Ed. Thomson	4th edition, 2000
	Reference	Quality Planning And Analysis	J.M. Juran Frank M. Gryna	McGraw Hill	2000

Course name:	**Course code:**
Quality Systems and Norms	II 511

Location in curricular map:
Specialization Axis

Course description:
The course seeks for the student to acquire knowledge of quality assurance systems, with the goal to apply them for the control and improvement in quality of products and services offered by organizations. The course covers procedures for quality assurance, from the detection of client needs to post-sale service, and also, the use and application of models and norms for said procedures. Students will learn concepts and models for assurance systems and norms, via a combination of reading, class participation, case studies, as well as other individual and group assignments. Students will work in a team environment, and practice their verbal, written and graphic communication skills to discuss and present information relating to the concepts studied throughout the course.

Course learning outcomes:
At the end of the course, the student will: • Comprehend the elements of a quality assurance system. • Apply various procedures and techniques that integrate a quality assurance system in a manufacturing or service organization. • Comprehend the structure of the current norms for quality assurance systems.

Course content:	**Hours**
1. Introduction to quality systems 1.1 Fundamental concepts 1.2 Quality in manufacturing and service systems 1.2 Infrastructure, processes and tools	2
2. Process management 2.1 Concepts and principles 2.2 Design processes 2.3 Delivery and production processes 2.4 Supply processes 2.5 Process improvement	8
3. Quality assurance 3.1 Assurance system design 3.2 Design control 3.3 Inspection and process test control 3.4 Product control and corrective actions 3.5 Equipment control 3.6 Information and registries 3.7 Service assurance systems	8
4. Assurance systems norms and models 4.3 Introduction 4.4 Norm models (ISO 9000,QS900, etc.) 4.3 Quality auditing 4.4 Certification and standardization	18

Learning activities guided by professor:	**Hours** **36**
1. Thematic exposition by professor	20
2. Laboratory practices and/or workshops guided by professor	OP
3. Presentation and/or discussion plenary guided by professor	6
4. Small group activities guided by professor	6
5. Individual activities guided by professor	4

Independent learning activities:	Hours 60
1. Reading of materials selected by professor. • The student must do individual reading to know and apply quality assurance systems.	20
2. Solving of case studies and problems selected by professor. • The student must solve case studies and problems assigned by the professor from the course bibliography.	10
3. Research and development of a topic selected by the professor. • This activity consists in the research of the various elements that comprise a quality assurance system.	10
4. Writing of an article. • The student must write an article in which he or she analyzes the structure of a quality system or current norm.	10
5. Integral course project. • The student will elaborate and present at the end of the course a final project related to the topics covered throughout the course. The objective of this project is the proposal of a quality assurance model for a particular organization.	10

Evaluation procedures and instruments:

The evaluation procedures and instruments are the following:

1. Written exam.
    - The student must prove to the professor via a written exam, the knowledge of the primary course topics.
2. Deliverables.
    - The student will deliver a report of the solutions for each of the case studies selected for each course unit.
    - The student will deliver a report of the research works assigned by the professor.
    - The student will deliver a technical article relating to the analysis of a quality assurance system or norm.
3. Presentations.
    - All students must present their final project to the group, on the day and hour that is established by the group and professor.
4. Participation in discussion sessions.
    - Students must participate in discussions of course content.

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

	Type	Title	Author	Publisher	Year
	Text	Quality control and management	James R. Evans William Lindsay	Ed. Thomson	4th edition, 2000
	Reference	ISO 9001:2000 Explained	Charles A. Cianfrani	ASQC	2001

Course name:	**Course code:**
Quality Engineering	II 512

Location in curricular map:
Specialization Axis

Course description:
During the course, the student will study various concepts and principles of quality engineering, particularly statistical models applied to quality control and improvement of products and processes. Also, students will be involved in the partial or total application of the tools studied throughout the course, via the use of case studies, as well as projects relating to their professional field. Students will apply statistical models for quality engineering, as well as the principles in which they are based, to the control and improvement of processes and products of human activity systems. Throughout the course, students will study statistical models of quality engineering, such as statistical process control, process capacity analysis and quality improvement models. Students will also work in a team environment, and practice their verbal, written and graphic communication skills to discuss and present information relating to quality engineering.

Course learning outcomes:

At the end of the course, the student will:

- Comprehend the basic principles of quality engineering.
- Identify the level and variation type in a process, establishing graphical models for the control of the variation in a process and evaluate the capacity or skill of the process.
- Apply the methodology for quality improvement based on statistical models.
- Apply basic elements of the software assigned for the course.

Course content:	Hours
1. Quality in a business environment 1.1 Quality background 1.2 The concept of quality 1.3 Total quality management 1.4 The importance of statistical methods in quality improvement	2
2. Methods and philosophy of statistical process control 2.1 Variation 2.2 Common and special causes for variation 2.3 Fundamentals of statistical process control 2.4 Applications of statistical process control	2
3. Statistical models for quality control 3.1 Introduction. 3.2 Statistical measures review 3.3 Control tools	20
4. Analysis of process capacity 4.1 Introduction 4.2 Process capacity indices	6
5. Statistical methods for quality improvement 5.1 Solution to chronic problems 5.2 Schemes for quality improvement and optimization (for example: 6 sigma) 5.3 Implementation of quality improvement	6

Learning activities guided by professor:	**Hours** **36**
1. Thematic exposition by professor	20
2. Laboratory practices and/or workshops guided by professor	12
3. Presentation and/or discussion plenary guided 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.	
• The student must do individual reading to know and apply the principles of design of experiments. Specifically, chapters 1, 2, 3, 4, 5, 6 and 9 of the Montgomery text.	20
• The student must read an application paper assigned by the professor, relating to quality engineering.	
2. Solution of problems selected by professor.	
• Student must solve problems from chapters 2, 3, 4, 5, 6 and 9 of the course text.	20
3. Lab practices.	
• The student must independently do the exercises of the guided lab workshop, using the software assigned to the course.	10
4. Research and development of a topic selected by the professor.	
• Optional activity, in which the student may exchange these independent hours for reading hours, or exchange for activities 1 and 2, with previous approval by the professor.	OP
5. Integral course project.	
• Consisting of a proposal by the student for a solution to a problem that implies the application of a methodology to solve a quality improvement project.	10

Evaluation procedures and instruments:

The evaluation procedures and instruments are the following:

1. Written exam.
    - The student must prove to the professor via a written exam, the knowledge of the primary course topics.
2. Deliverables.
    - The student will deliver a report of the solutions for each of the case studies selected for each course unit.
    - The student will deliver a report of the research works assigned by the professor.
3. Presentations.
    - All students must present their final project to the group, on the day and hour that is established by the group and professor.
4. Participation in discussion sessions.
    - Students must participate in discussions of course content.

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

	Type	Title	Author	Publisher	Year
	Text	**Introduction to Statistical Quality Control**	**Douglas C. Montgomery**	**John Wiley and Sons**	**4TH Edition,2001**
	Reference	CREATING QUALITY, CONCEPTS, SYSTEMS, STRATEGIES AND TOOLS	William J. Kolarik	McGraw Hill ISBN 0-07-035217-8	2001
	Reference	STATISTICAL METHODS FOR QUALITY IMPROVEMENT	Thomas P.Ryan	John Wiley and Sons, inc., 2000	2000
	Reference	IMPLEMENTING SIX SIGMA	Forrest W. Breyfogle III	John Wiley and Sons, inc., 2000	Ed. John Wiley and Sons, inc., 2000 1999

Course name:	**Course code:**
Statistical Models for Quality Improvement	II 513

Location in curricular map:
Specialization Axis

Course description:
During the course, the student will study various concepts and principles of quality engineering, particularly statistical models applied to quality control and improvement of products and processes, seeking to generate a conceptual framework for a methodology for to design, conduct and analyze industrial experiments. Also, students will be involved in the partial or total application of the tools studied throughout the course, via the use of case studies, as well as projects relating to their professional field. Students will learn the fundamental concepts and models for experiment design, via reading, class participation, problem solving and other individual and group activities. Students will also work in a team environment, and practice their verbal, written and graphic communication skills to discuss and present information relating to quality engineering.

Course learning outcomes:
At the end of the course, the student will: • Know the basic principles of experiment design, as well as the methodology to conduct an experimental design based on statistics. • Comprehend the scope of design and statistical experiment analysis, for the improvement of products and processes. • Design and analyze industrial experiments and correctly interpret their results to identify and improve the sources of quality variation in a product or process. • Apply the basic elements of the software assigned for the course.

Course content:	Hours
1.Introduction to quality engineering and design of experiments	4
1.1 Fundamental concepts of quality engineering	
1.2 Introduction to the design of experiments	
1.3 Basic principles of design of experiments	
1.4 Methodology for design of experiments	
2. Single factor experiments	16
2.1 Completely random experiments	
2.2 Random block design	
3. Factorial experiments	20
3.1 General factorial experiments	
3.2 2k factorial experiments	
3.3 Fractional factorial experiments	
4. Process improvement and optimization	8
4.1 Response surface methodology	
4.2 Case and project presentations	

Learning activities guided by professor:	Hours 36
1. Thematic exposition by professor	20
2. Laboratory practices and/or workshops guided by professor	12
3. Presentation and/or discussion plenary guided 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. • The student must do individual reading to know and apply the principles of design of experiments. Specifically, chapters 1,3,4,5,6,8,10 and 11 of the Montgomery text. • The student must read an application paper assigned by the professor, relating to design of experiments.	20
2. Solution of problems selected by professor. • Student must solve problems from chapters 3,4,5,6,8,10 and 11 of the course text.	20
3. Lab practices. • The student must independently do the exercises of the guided lab workshop, using the software assigned to the course.	10
4. Research and development of a topic selected by the professor. • Optional activity, in which the student may exchange these independent hours for reading hours, or exchange for activities 1 and 2, with previous approval by the professor.	OP
5. Integral course project. • Consisting of a proposal by the student for a solution to an application problem using design of experiments.	10

Evaluation procedures and instruments:

The evaluation procedures and instruments are the following:

1. Written exam.
    - The student must prove to the professor via a written exam, the knowledge of the primary course topics.
2. Deliverables.
    - The student will deliver a report of the solutions for each of the case studies selected for each course unit.
    - The student will deliver a report of the research works assigned by the professor.
3. Presentations.
    - All students must present their final project to the group, on the day and hour that is established by the group and professor.
4. Participation in discussion sessions.
    - Students must participate in discussions of course content.

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

	Type	Title	Author	Publisher	Year
	Text	Design and Analysis of Experiments	Douglas C. Montgomery	John Wiley and Sons	5TH Edition,2001
	Reference	Understanding Industrial designed Experiments	Stephen R. Schmidt and Robert G. Launsby	AIR Academy Press	Fourth Edition,1994
	Reference	Design of experiments	Robert O.Kuehl	Thomson	Second edition, 2001
	Reference.	Analysis and design of experiments	Humberto Gutierrez Pulido y Román de la Vara	McGraw Hill	First edition, 2004

Course name:	**Course code:**
Production Systems	II 514

Location in curricular map:
Specialization Axis

Course description:
During the course, the student will study various concepts and principles of production systems, particularly those related to the efficient transformation of resources into goods, with the goal of developing a conceptual reference frame for the production function, and the application of various strategies and models used in the design and operation of production systems. Also, students will be involved in the partial or total application of the tools studied throughout the course, via the use of case studies, as well as projects relating to their professional field. Students will learn the concepts and models relating to the field of operations and production management, via a combination of reading, class participation, problem solving and other individual and group assignments. Students will also work in a team environment, and practice their verbal, written and graphic communication skills to discuss and present information relating to quality engineering.

Course learning outcomes:
At the end of the course, the student will: • Comprehend the fundamental principles and concepts of production system management. • Comprehend the scope of the operations management function and production systems in the achievement of a competitive position for the organization. • Application of the various strategies and models for the design and operation of production systems. • Apply the basic elements of the software assigned for the course.

Course content:	Hours
1. Introduction to production and operations management 1.1 Production systems 1.2 Operations	2
2.Operations and competitiveness strategy 2.1 Operations strategy 2.2 Operations priorities 2.3 Productivity 2.4 Productivity measurement	4
3. Project management 3.1 Project management 3.2 Project planning 3.3 Project control techniques	6
4. Product design and process selection 4.1 The product design process 4.2 Design processes 4.3 Process design and selection 4.4 Operations technology	8
5. Facilities design: location and distribution 5.1Capacity planning 5.2 Aspects relating to facilities location 5.3 Basic types of distribution	8
6. Supply chain management 6.1 Scope of the supply chain 6.2 Buying 6.3 Just in time production	8

Learning activities guided by professor:	**Hours** **36**
1. Thematic exposition by professor	24
2. Laboratory practices and/or workshops guided by professor	8
3. Presentation and/or discussion plenary guided 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. • The student must do individual reading to know and apply the principles of the design and operation of production systems. Specifically those in the chapters of the course text.	20
2. Solution of problems selected by professor. • Student must solve problems assigned from chapters of the course text.	20
3. Lab practices. • The student must independently do the exercises of the guided lab workshop, using the software assigned to the course.	10
4. Research and development of a topic selected by the professor. • Optional activity, in which the student may exchange these independent hours for reading hours, or exchange for activities 1 and 2, with previous approval by the professor.	OP
5. Integral course project. • Consisting of a proposal by the student for a solution to an application problem that implies the use of strategies and models for the design and operation of production systems.	10

Evaluation procedures and instruments:

The evaluation procedures and instruments are the following:

1. Written exam.
    - The student must prove to the professor via a written exam, the knowledge of the primary course topics.
2. Deliverables.
    - The student will deliver a report of the solutions for each of the case studies selected for each course unit.
    - The student will deliver a report of the research works assigned by the professor.
3. Presentations.
    - All students must present their final project to the group, on the day and hour that is established by the group and professor.
4. Participation in discussion sessions.
    - Students must participate in discussions of course content.

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

	Type	Title	Author	Publisher	Year
	Text	**Operations Management For Competitive Advantage**	**Richard B. Chase, Robert Jacobs and Nicholas J. Aquilano**	**Irwin Inc.**	**Tenth edition, 2004**
	Reference	Production/Operations Management	William J.Stevenson	Irwin Inc.	Fifth edition,1996
	Reference	Production/Operations Management	James R. Evans	West Publishing Company	Fifth edition, 1997

Course name:	**Course code:**
Application of Optimization Models I	II 515

Location in curricular map:
Specialization Axis

Course description:
The student will apply deterministic optimization models, to plan and design industrial systems of human activity. During the course, the student will use application software for linear programming to formulate, solve and interpret solutions to problems relating to the assignment of resources to competing areas of production programming, personnel programming, product mix as well as merchandise and product distribution logistics. The student will do a final project that consists of the application of the studied techniques to solve a real problem.

Course learning outcomes:

At the end of the course, the student will:

- Comprehend deterministic optimization models, their origins, applications in industrial and service organizations, as well as the methodologies frequently used.
- Design systems that use mathematical models for optimization for decision making.
- Identify the most important relationships of deterministic optimization models with the masters studies and the exercise of the profession.
- Identify the conditions or assumptions by which a model of linear programming may used to find the optimal solution of a problem.
- Formulate linear programming models based upon the description of a problem.
- Solve linear programming problems with the support of a computer program and do sensitivity analysis.
- Formulate and solve linear programming problems using computer software.
- Formulate and solve network problems, such as assignment, transport and transference using computer programs for their solution.

Course content:	Hours
1 Introduction to optimization models. 1.1 What are deterministic optimization models? 1.2 Brief history of deterministic optimization models. 1.3 The process of application of deterministic optimization models. 1.4 Applications of deterministic optimization models. 2 Introduction to linear programming . 2.1 The linear programming model and basic assumptions. 2.2 Application process of linear programming an additional examples. 2.3 Graphic solution using WinQSB (software package). 2.4 Adapting to other forms of the model. 2.5 Sensibility analysis. 3 Whole linear programming. 3.1 Introduction to whole linear programming. 3.2 Solving whole linear programming problems. 3.3 A personnel programming problem. 4 Network models. 4.1 Assignment problem. 4.2 Transport problem. 4.3 Transfer problem. 4.4 Other applications.	4 12 10 10

Learning activities guided by professor:	Hours 36
1. Thematic exposition by professor	16
2. Application model solving workshop guided by professor	16
3. Presentation and/or discussion plenary guided 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. • The student must do individual readings to know and comprehend the origins and nature of operations research and deterministic optimization models. Chapters 1 and 2 of the course text and Chapter 1 of reference text 1. • The student must readings of linear programming application problems, that show various situations that solve real problems. Reference texts 1 through 5 may be used.	10
2. Writing of an article, essay or reading summary. • The student will write a technical article where an application problem is presented in which linear programming may be used as a tool. This activity should induce the student to reflect upon the final project as well as the abilities that must be acquired throughout the masters studies.	10
3. Solution of problems selected by professor. • The student must solve at least 10 problems of maximization and minimization, using linear programming in specific situations.	10
4. Lab practices. • The student must independently do the exercises of the guided lab workshop, doing variations of these. The workshop is based on chapter 3 of the course text as well as reference texts 1 through 5. Software from reference text 6 will be used to solve the problems and do sensitivity analysis that helps answer the question "What happens if…?".	10
5. Research and development of a topic selected by the professor. • Optional activity, in which the student may exchange these independent hours for reading hours, or exchange for activities 1 and 2, with previous approval by the professor.	OP
6. Integral course project. • To be worked in teams of 2 or 3 students. Consisting of the implementation of the situation stated in activity 2.	20

Evaluation procedures and instruments:

Homework tasks (20%) Each homework task must have a cover, in white paper, with the student's information (name, student number, homework number and name or brief description of homework, date of homework). Homework tasks will not be accepted after due date. Some homework tasks will be individual and others in teams. The ability and clarity the student manifests in solving the linear programming will be evaluated, as well as the correct application of the appropriate solution algorithm for the case. It is important not only numeric results be presented but also an explanation of the procedure, an interpretation of the numeric result and a conclusion for the case.

Partial examinations (30%) Partial examinations will be administered in the dates established initially with the group.

Final project (30%) Consisting of the application of the studied techniques to the solution of a problem from the student's work field.

Presentations and class participation (20%) The disposition for participation in a pro-active manner in class and class presentations is important. The commitment of each student to achieve the unit and course learning outcomes will be evaluated, as well as the creativity manifested in the development of the learning activities and disposition for working in teams.

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

Lawrence J.A. Jr., and Pasternack B. A., "Applied Management Science, A Computer Integrated Approach For Decision Making", John Wiley and Sons, N.Y., 1998

References

1. Hillier, Frederick S. y Lieberman, Gerald J., "Introduction to operations research", McGraw-Hill Interamericana Publishers, Seventh edition México, D. F., 2002

2. Winston, Wayne L., "Operations research applications and algorithms", Publisher Iberoamerica Group, México, D. F. 1994.

3. Taha Hamdy A., "Operations research", Alfaomega Group Publisher, México, D. F. 1995

4. Mathur, K., y Solow D., "Operations research. The art of decision making", Prentice-Hall Hispanoamericana, México, D. F. 1994

5. INFORMS, Magazine of the "**In**stitute **F**or **O**perations **R**esearch and **M**anagement **S**ciences"

6. Chang Y. L. "Decisions Support Software for MS/OM", John Wiley and Sons, N. Y. 2004

Course name:	**Course code:**
Application of Optimization Models II	II 516

Location in curricular map:
Specialization Axis

Course description:
The student will apply optimization techniques to problems of a probabilistic nature, related to the design, analysis, management, and optimization of systems of human activity. Specifically, the student will use the decision making process the probabilistic models that operations research have developed, to describe and solve problems: decision analysis, Markov chains, queues, and inventory models.

Course learning outcomes::

At the end of the course, the student will:

- Explain probabilistic models for operations research, their origins, applications in industrial and service organizations and the most frequently used methodology.
- Design systems that use probabilistic models for operations research for the optimization in decision making.
- Identify the most important relationships that probabilistic models for operations research have with the masters studies and the exercise of the profession.
- Identify the conditions or assumptions by which probabilistic models may be used to find for the optimal solution of a problem.
- Formulate and solve problems relating to Markov chains, queues, and inventory control based upon the description of a problem.
- Solve Markov chain problems with the support of a computer program and do sensitivity analysis.
- Formulate and queue and inventory control problems using computer software.

Course content:	Hours
1 Decision analysis 1.1 Introduction to decision analysis 1.2 A priori decision making 1.3 A posteriori decision making 1.4 The value of perfect information 1.5 Decision trees	8
2 Markov chains 2.1 Stochastic processes 2.2 Steady state probabilities 2.3 Classification of states in a Markov chain 2.4 Markov decision processes	8
3 Queues – Queue theory and applications 3.1 Structure of queue models 3.2 Role of the exponential distribution 3.3 Birth and death process 3.4 Basic queue models 3.5 Applications of queue models	12
4 Inventory models 4.1 Stationary demand models 4.2 Determination of security inventories 4.3 Non-stationary demand 4.4 MRP	8

Learning activities guided by professor:	Hours 36
1. Thematic exposition by professor	16
2. Application model solving workshop guided by professor	16
3. Presentation and/or discussion plenary guided 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.	
• The student must do individual readings to know and comprehend the origins and nature of operations research and probabilistic models. Chapters 1 and 2 of the course text and Chapter 1 of reference text 1.	10
• The student must readings of probabilistic models application problems, that show various situations that solve real problems. Reference texts 1 through 5 may be used.	
2. Writing of an article, essay or reading summary.	
• The student will write a technical article where an application problem is presented in which probabilistic models may be used as a tool. This activity should induce the student to reflect upon the final project as well as the abilities that must be acquired throughout the masters studies.	10
3. Solution of problems selected by professor.	
• The student must solve at least 10 problems relating to probabilistic models in specific situations.	10
4. Lab practices.	
• The student must independently do the exercises of the guided lab workshop, doing variations of these. The workshop is based on chapter 3 of the course text as well as reference texts 1 through 5. Software from reference text 6 will be used to solve the problems and do sensitivity analysis that helps answer the question "What happens if…?".	10
5. Research and development of a topic selected by the professor.	
• Optional activity, in which the student may exchange these independent hours for reading hours, or exchange for activities 1 and 2, with previous approval by the professor.	OP
6. Integral course project.	
• To be worked in teams of 2 or 3 students. Consisting of the implementation of the situation stated in activity 2.	20

Evaluation procedures and instruments:

Homework tasks (20%) Each homework task must have a cover, in white paper, with the student's information (name, student number, homework number and name or brief description of homework, date of homework). Homework tasks will not be accepted after due date. Some homework tasks will be individual and others in teams. The ability and clarity the student manifests in solving the linear programming will be evaluated, as well as the correct application of the appropriate solution algorithm for the case. It is important not only numeric results be presented but also an explanation of the procedure, an interpretation of the numeric result and a conclusion for the case.

Partial examinations (30%) Partial examinations will be administered in the dates established initially with the group.

Final project (30%) Consisting of the application of the studied techniques to the solution of a problem from the student's work field.

Presentations and class participation (20%) The disposition for participation in a pro-active manner in class and class presentations is important. The commitment of each student to achieve the unit and course learning outcomes will be evaluated, as well as the creativity manifested in the development of the learning activities and disposition for working in teams.

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

Lawrence J.A. Jr., and Pasternack B. A., "Applied Management Science, A Computer Integrated Approach For Decision Making", John Wiley and Sons, N.Y., 1998

References

1. Hillier, Frederick S. y Lieberman, Gerald J., "Introduction to operations research", McGraw-Hill Interamericana Publishers, Seventh edition México, D. F., 2002

2. Winston, Wayne L., "Operations research applications and algorithms", Publisher Iberoamerica Group, México, D. F. 1994.

3. Taha Hamdy A., "Operations research", Alfaomega Group Publisher, México, D. F. 1995

4. Mathur, K., y Solow D., "Operations research. The art of decision making", Prentice-Hall Hispanoamericana, México, D. F. 1994

5. INFORMS, Magazine of the "**In**stitute **F**or **O**perations **R**esearch and **M**anagement **S**ciences"

6. Chang Y. L. "Decisions Support Software for MS/OM", John Wiley and Sons, N. Y. 2004

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				