College of Engineering

Academy of Mechanical Engineering

Bachelor in Mechanical Engineering

Program Review

2013

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1. Introduction.

This paper presents the results generated by the Academy of Mechanical Engineering for the revision of the Mechanical Engineering program. The Mechanical Academy consists of the following members:

- M.S. Bernardo Valadez – Mexicali Campus.
- M.S. Rubén Magdaleno – Tijuana Campus.

The Faculty that are associated with the program, and who are members of the Academy of Mechanical Engineering are:

- M.S. Bernardo Valadez – Mexicali Campus.
- M.S. Maribel Lazcano – Mexicali Campus.
- M.S. Alma Abad – Mexicali Campus.
- M.S. Jesús Corona – Mexicali Campus.
- Dr. Harvi Alirio Castillo – Tijuana Campus.

In addition, a program review work team was created in the first half of 2011, composed by the leaders of the Academy and the group involved in the review and evaluation processes of the program, as well as the University's staff. The purpose of the group was to provide a peer review team for the program's review processes and provide timely and multidisciplinary feedback for the academies. In addition to the feedback provided by the group, the academy professors have participated in various program review and evaluation workshops conducted by external consultants, and the program review documents as well as the evaluation plans were reviewed by external consultants and experts who provided comments and feedback.

The components of the review presented in this document reflect the methodology followed by the Academy to undergo the review process, which begins with an analysis of the mission and vision of the program and its educational objectives and learning outcomes, along with the curricular mapping and assessment processes, identifying indicators for student achievement and analysis of students, faculty resources and support. It also includes the information obtained in the comparative analysis with other reviewers from external programs. The areas of opportunity and recommendations defined by the Academy during the process and reflected in this document are presented to the College of Engineering, which in turn will be submitted to the Academic Vice Presidency to be considered for implementation in the next version of the academic programs.

An improvement plan is presented in the final section of this paper. It includes the main activities proposed to make the necessary changes according to the results of the analysis.

2. Revision of the mission, vision and educational objectives.

For the analysis of the Mission and Vision of the Mechanical Engineering program, we begin with identifying some important historical and contextual information, as well as significant achievements of the program:

- The first generation of Mechanical Engineering graduated in 1983.
- CETYS was the first university in northwestern Mexico to start a program of computer-aided design in 1985.
- CETYS University Mexicali Campus is the only university in Baja California that has a student chapter of ASME since 1995.
- CETYS University Mexicali Campus is the only university in Baja California that has a student chapter of SAE since 2001.
- The program received the first accreditation of CACEI (organization in Mexico that is equivalent to ABET in USA) in February 2006 and the second in late 2012.
- Graduates of the program have boosted the areas of computer-aided design in Mexicali companies such as Kenworth, Accuride, Jonathan, MRTC Honeywell, U.S. Elevators, etc..
- Graduates of the program have been successful entrepreneurs by creating the companies: Metalium (in Tijuana), Persal (Mexicali), Metalco (Mexicali), Termec (Mexicali), Maintenance of cranes (Mexicali), Tecnografica (in Tijuana) , to name a few.
- Graduates of the program have obtained master's degrees from the Massachusetts Institute of Technology, University of Leeds, University of Warwick, University of Birmingham, ITESM, etc.
- Graduates of the program have earned doctorate degrees in Urbana Champaign Illinois, Arizona State University, etc.
- Graduates of the program have worked in foreign companies such as: Driessen train division in Vermont, Canada, Driessen Design Center in Garden Grove, CA., Engineering Manager of Boeing in Long Beach, CA., to name a few.

The total number of graduates of the program in the Mexicali Campus is around 238 and in the Tijuana Campus around 25.

Three aspects are considered in the analysis of the Mission and Vision of the Mechanical Engineering Program: alignment with the institutional Mission and Vision, impact in the regional and national development, level of alignment of the program with the current educational objectives.

The Bachelor in Mechanical Engineering Program is focused on the following Primary Areas of Knowledge, also called Professional Formation Lines:

a) Mechanical Design
b) Materials
c) Thermal
d) Manufacture

Also, as part of the school of engineering 2007 program update, the following Complementary Areas of Knowledge also known as Complementary Formation Lines, or Emphasis options of the program have been added,:

a. Aerospace Design
b. Automotive Design

In addition to the above mentioned elements, CETYS University's educational model promotes the integral development of its professionals, which includes critical thinking, global and international mindsets, information literacy, values and the contribution to social, economic and technological development and sustainability.

The Mission and Vision for the Mechanical Engineering Program, established as a part of the previous review process states:

Current Mission.

The mission of the Bachelor in Mechanical Engineering is to produce highly qualified professionals in mechanical design, with a view toward teamwork and with the support of integrated modules of mechanical analysis and computer simulation that allows shortening the time between conceptualization and development of a prototype for the manufacture of products. These professionals will have a stranglehold on the skills required to formulate and solve mechanical design, product and specialized equipment for manufacture problems. The solutions will consider the impact on the environment, society and sustainable development.

Current Vision.

The Vision of the Bachelor in Mechanical Engineering is to remain a leader in the area of mechanical design in the region, focused on the development of professionals in the engineering industry with an emphasis on the skills required in the program's four primary areas: manufacturing, materials, thermal and mechanical design.

As we analyze the institutional mission and the mission of the academic program, we conclude that the second complements the first one. The mission of CETYS University as well as the mission of the Bachelor in Mechanical Engineering Program point out the importance of the development of "intellectual capacity." However, the mission of the program does not explicitly specify the importance of the "moral capacity" development in the students, but by "professionals" it means a "high standard of professional ethics, behavior and work activities while carrying out one's profession" and thus implicitly refer to the "moral capacity" as mentioned in the institutional mission.

The mission statement of CETYS University is as follows:

It is the purpose of the Centro de Enseñanza Técnica y Superior to contribute in the education of persons with the moral and intellectual capacity required to participate in an important way in the economic, social, and cultural improvement of the country. CETYS University seeks, as a result, to make indestructible those values that have traditionally been considered as basic so man can live in society in a peaceful way, and satisfy the needs that his capacity to do work allows him.

The institutional mission points out the following points regarding students:

- Moral and intellectual capacity for the economic, social, and cultural improvement of the country.
- Basic values for living in society in a peaceful way and the satisfaction of their needs that their capacity to do work allow them.

We understand as moral capacity that the students should be decent, respectful, and noble persons; regardless of the profession they choose to undertake. This would allow them to live a successful life despite of the socioeconomic level. The institutional mission points out the intellectual capacity of graduates suitable for successfully carrying out the work that their profession demands. In other words, the value of students as persons and as professionals should be guided towards the “economic, social, and cultural improvement of the country.”

The second part of the institutional mission points out that the students must be able to satisfy their needs through their work and by living in peace with the rest of the people. Once again, we can detect the existence of the students’ ability in their profession as well as the respect to others.

The review process of the mission and vision of the program was performed taking into account the elements set out in:

1. Mission and Vision of the Institution
2. Mission and Vision of the School of Engineering
3. Mission and Vision Current Mechanical Engineering Program

The Mechanical Engineering Academy, as a result of the analysis process, has redefined the mission and vision of the program as follows:

MISSION:

Assist in the training of professionals, leaders in solving problems of mechanical engineering, highly competent in the application and development of new technologies, with a global and international vision and the capacity to meet the challenges of the environment in which they unfold, in an ethical way and with a vocation oriented towards the service to society.

VISION:

Being leaders in the training of Mechanical Engineers, recognized for their excellent professional level and a high commitment towards innovation, and the integrated and sustainable development of society.

The mission of the academic program strengthens the institutional commitment to train professionals that are able to excel in their field of work, emphasizing leadership and being highly competent in their profession. It also states, explicitly, the ability of graduates to face

the challenges that their profession demands ethically and serving society, with a global and international vision.

The vision of the academic program reaffirms the institutional commitment of training people committed to the sustainable development of society, adding the commitment to innovation.

The program's vision also points out clearly the leadership and excellence in the training of mechanical engineers, this should be reflected in curricular and co-curricular courses, departments, support and infrastructure centers that in a way, impact the academic program.

The following Educational Objectives stem from the institutional mission and the academic program:

- Graduates of this program will be able to participate significantly in projects related to mechanical engineering.
- Graduates of this program will be able to pursue graduate studies with success.
- Graduates of this program will be able to find a professional job within 6 months after graduation.
- Graduates of this program will be able to start their own business.
- Graduates of this program will be able to reach mid-level positions in 3 years and a managerial level within 5 years.

3- Revision of the program’s capacity

3.1 Structure of the program

CETYS University's academic programs at the Bachelor level, have the following structure and degree obtainment requirements:

- Accreditation of 42 subjects (totaling 328 credits) for the 2004 programs and 42 subjects plus 4 additional Complementary Formation Line subjects (totaling 360 credits) for the 2007 programs.
- Completing 400 hours of professional practice.
- Completing 500 hours of social service.
- Completing the corresponding EGEL (undergraduate exit test) examination administered by CENEVAL (organization in México that offers various examination services).

The 46 subjects that a student takes for the automotive specialty, as well as the aerospace specialty are distributed in the following way:

- 10 subjects pertain to General Education, meaning that these are subjects that all students enrolled in any university program will take.
- 15 subjects pertain to Engineering Education. These are subjects that all students enrolled in a program of the school of engineering will take.
- 21 subjects pertain to Professional Education. These are subjects that all students enrolled in the Mechanical Engineering program will take.
- The 21 subjects of the Mechanical Engineering program mentioned in the previous paragraph have subdivisions of subjects in the areas of manufacture, materials, thermal and design.

The distribution of subjects in quantity and percentage that would correspond to the 46 subjects in the program are shown in the following table.

<table>
<tr><th>General Education</th><th>Common Engineering Subjects</th><th colspan="5">Mechanical Engineering Subjects</th></tr>
<tr><td rowspan="3">10
(21.7%)</td><td rowspan="3">15
(32.7%)</td><td colspan="5">21 (45.6%)</td></tr>
<tr><td>Manufacturing</td><td>Materials</td><td>Thermal</td><td colspan="2">Design</td></tr>
<tr><td>3
(6.5%)</td><td>3
(6.5%)</td><td>3
(6.5%)</td><td>Analysis
6
(13.05%)</td><td>Mechanical Design
6
(13.05%)</td></tr>
</table>

The curriculum map for the review of the program shown in the following page focuses on 36 specific program subjects. The colors shown in that list indicate the type of subject, according to what was specified in the previous table.

MECHANICAL ENGINEERING

CURRICULAR ELEMENTS		
CODE	COURSE	SEMESTER
MA400	Mathematics for University	1
CC400	Programming Methods I	1
MC400	Computer Aided Drawing	1
MA401	Differential Calculus	1
CC402	Programming Methods I	2
FI400	Physics I	2
MA402	Integral Calculus	2
FI401	Physics II	3
MA403	Numerical Methods	3
MA404	Probability	3
MA407	Differential Equations	4
FI402	Physics III	4
MA406	Multivariable Calculus	5
MC401	Introduction to Mechanical Engineering	1
MC413	Plant Engineering	8
MF400	Materials Properties	2
MF401	Materials Manufacturing	3
MC402	Mechanics of Materials	4
MF402	Computer Aided Fabrication	4
MC403	Fluid Mechanics	5
MC404	Introduction to Design	5
MC405	Physical Metalurgy	5
MC406	Finite Modeling	6
MC407	Electro-Pneumatic and Hydraulic Systems	6
MC408	Thermodynamics	6
MC409	Design Engineering	7
MC410	Dynamics of Mechanisms	7
MC411	Automation and Control	7
MC412	Mechanical Experimental Analysis	8
MC414	Heat Transfer	8
Emphasis in Automotive Design Courses		
MC417	Materials Engineering	5
MC416	Mathematical Models of Mechanical Systems	6
MC420	Resistance automotive body structures	7
MC419	Finite Element automotive applications	8
MC418	Automotive Conceptual Design	7
MC421	Automotive prototyping	8
Emphasis in Aerospace Design Courses		
MC423	Materials Engineering	5
MC422	Mathematical Models of Mechanical Systems	6
MC425	Finite Element aerospace applications	8
MC426	Resistance aerospace body structures	7
MC424	Aerospace Conceptual Design	7
MC427	Aerospace prototyping	8

3.2 Institutional Program and Institutional Learning Outcomes

The Student Learning Outcomes for an academic program are divided into two main blocks: Institutional Learning Outcomes and Program Learning Outcomes. The Institutional Learning Outcomes are defined and reviewed by the Academy of Institutional Learning Outcomes. The Program Level Learning Outcomes are defined and reviewed by the Academies.

The Institutional Learning Outcomes are four and focus on: Verbal and Written Communication Skills, Critical Thinking, Continuous Learning/Information Literacy and Tolerance to Diversity.

The Program Level Learning Outcomes, for the programs offered by the College of Engineering are divided into two blocks: learning outcomes common to all engineering programs (with a strong emphasis on basic sciences and problem solving) and learning outcomes specific to the academic program (with a strong emphasis on the primary and complementary areas of knowledge of the program.

This document will focus on the analysis and review process for the Program Level learning outcomes done by the College of Engineering and the Academy of Mechanical Engineering.

The Program Level Learning Outcomes that apply to all engineering programs, defined in the previous program review process (included in Evidence #35 of the Capacity Report for the WASC Initial Accreditation), were five and were identified as follows:

The student of a CETYS University Bachelor's in Engineering Program will…

- SLO_ENG1: …correctly apply to engineering, the tools provided by the basic sciences, such as physics, calculus, probability, statistics and programming to the solution of diverse problems.
- SLO_ENG2: …design analytic and functional models, quantitatively and qualitatively, for the analysis and improvement of systems for diverse applications.
- SLO_ENG3: … effectively use software tools and technologies to build solutions to engineering problems.
- SLO_ENG4: … effectively design and manage projects.
- SLO_ENG5: … (Clear and effective communication in English) … be able to express his ideas clearly and with an appropriate language, in a verbal, written, and visual way in English.

Review of these learning outcomes took into consideration the following three general guidelines:

1. Since these learning outcomes apply to all engineering programs, all Academies should participate in the review process.

2. As a part of the WASC process, recommendations were made with regards to the amount of learning outcomes with regards to assessment implications, thus integration of learning outcomes to reduce the amount is desirable.
3. The learning outcome that has to do with “Clear and effective communication in English” must be included.

The Academies analyzed the five original learning outcomes and re-defined them into the following three Program Level Learning Outcomes that apply to all engineering programs:

The student of a CETYS University Bachelor’s in Engineering Program will…

- SLO_ENG1: …solve problems relating to the improvement of diverse systems, correctly applying the knowledge and tools provided by the basic sciences and/or software technologies.
- SLO_ENG2: … effectively design and manage projects.
- SLO_ENG3: … (Clear and effective communication in English) … be able to express his ideas clearly and with an appropriate language, in a verbal, written, and visual way in English.

This re-definition allows for a more clear identification of the learning outcomes expected for all engineering programs, and also allows for the design of a more manageable program level assessment process and plan (which will be explained in further sections of this document).

Also as a part of the previous program review process, Program Level Learning Outcomes that apply to specific engineering programs were defined (also included in Evidence #35 of the Capacity Report for the WASC Initial Accreditation). These learning outcomes, for Mechanical Engineering Program were four and were identified as follows:

The student of the Bachelor’s in Mechanical Engineering program will…

- SLO_IM1: … apply the theoretical and practical fundamentals of material properties in engineering, to make the optimal selection of materials for a given application.
- SLO_IM2: … evaluate diverse fabrication alternatives for products, analyzing aspects regarding ease of manufacturing, resource optimization and evaluation of modern manufacturing technologies.
- SLO_IM3: … design and evaluate thermal systems to produce and consume power, and be able to evaluate the thermal efficiency of these systems.
- SLO_IM4: … design, analyze and evaluate diverse machine elements and mechanical systems to obtain their optimal performance.

The Academy of Mechanical Engineering analyzed the four original learning outcomes and re-defined them into the following four Program Level Learning Outcomes that apply specifically to the Mechanical Engineering program:

The student of the Bachelor's in Mechanical Engineering program will…

- SLO_IM1: Apply the theoretical and practical fundamentals of the properties of engineering materials, for the optimal selection of materials given an application.

- SLO_IM2: Evaluate various alternatives in the production of products analyzing the aspects of ease of manufacture, resource optimization and evaluation of various modern manufacturing technologies.

- SLO_IM3: Devise thermal systems for producing and consuming power, evaluating their thermal efficiency.

- SLO_IM4: Devise, analyze and evaluate different elements of machines and mechanical systems for optimal performance.

This re-definition also allows for a more clear identification of the learning outcomes expected for the Mechanical Engineering program, and updates them, taking into account assessment considerations.

The program level learning outcomes that are specific to Mechanical Engineering and have to do with the complementary areas of knowledge (also known as Complementary Formation Lines, or Emphasis options) remain the same:

The student of the Bachelor in Mechanical Engineering with an Emphasis in Aerospace Design will…

- SLO_DAS: … design functional subsystems of an airplane, such as aero-structures, fuselage, landing gear, wings, steering, propulsion, brakes, etc., and be able to simulate them in a computer end fabricate prototypes for testing and verification.

The student of the Bachelor in Mechanical Engineering with an Emphasis in Automotive Design will…

- SLO_DAM: … design functional subsystems of an automobile, such as structures, chassis, suspension, transmission, brakes, etc. and be able to simulate them in a computer end fabricate prototypes for testing and verification.

The curricular mapping for the program level learning outcomes, in their redefined versions according to section 3 of this document, considers the following levels:

- DEVELOPMENT (DE): *"At the end of the course, the students know, understand, comprehend and are familiar with the course topics".* It is expected that students have little or no knowledge of the course topics previous to the course. Knowledge and abilities acquired from previous courses may be used to develop students in the solution of problems of low to medium level complexity. New topics are introduced with a basic application level, sufficient enough for the student to comprehend implications for further applications. It is expected for the student to relate previous concepts and integrate them to his or her new base of knowledge, identifying applications via the identification and solutions of problems and cases at a basic level.

- SATISFACTORY (SA): "At the end of the course the students are able to analyze and apply course topics in various contexts, which present diverse levels of difficulty*"*. Knowledge, skills and abilities acquired from previous courses are used to develop solutions to application problems, of medium to high level complexity, relating to the area of knowledge of the profession. It is expected that the student develop a higher level of analysis skills and learn to use in a more efficient manner the tools and methodologies relating to the area of knowledge of the profession.

- EXAMPLARY - (EX): *"At the end of the course, the students exhibit an integrated understanding of the course topics and their application, knowing when and how to apply them".* Knowledge, skills and abilities acquired throughout previous courses are used to identify and solve problems, where the student is expected to design, integrate and evaluate tools and methodologies relating to the area of knowledge of the profession.

It is important to note that the curricular mapping of the Institutional Level Learning Outcomes for all academic programs uses a three level scale that is consistent with the above levels, using different nomenclature (Development, Satisfactory and Examplary).

The following table presents the curricular mapping for the Mechanical Engineering program (Program Level Learning Outcomes):

CURRICULAR ELEMENTS			ENGINEERING BACHELOR'S PROGRAMS STUDENT LEARNING OUTCOMES			BACHELOR'S IN MECHANICAL ENGINEERING STUDENT LEARNING OUTCOMES				EMPHASIS OPTIONS FOR MECHANICAL ENGINEERING STUDENT LEARNING	
			SLO_ENG1	SLO_ENG2	SLO_ENG3	SLO_IM1	SLO_IM2	SLO_IM3	SLO_IM4	SLO_AERO	SLO_AUTOM
CODE	COURSE	SEMESTER	LEVEL	LEVEL	LEVEL	LEVEL	LEVEL	LEVEL	LEVEL	LEVEL	LEVEL
MA400	Mathematics for University	1	DE	DE	DE						
CC400	Programming methods I	1	DE	DE	DE						
MC400	Computer Aided Drawing	1	DE	DE	DE						
MA401	Differential Calculus	1	DE	DE	DE						
CC402	Programming methods I	2	SA	SA	SA						
FI400	Physics I	2	DE	DE	DE						
MA402	Integral Calculus	2	SA	SA	DE						
FI401	Physics II	3	SA	SA	DE						
MA403	Numerical Methods	3	DE	DE	DE						
MA404	Probability	3	DE	DE	DE						
MA407	Differential Equations	4	EX	EX	DE						
FI402	Physics III	4	SA	SA	DE			DE			
MA406	Multivariable Calculus	5	EX	SA	DE						
MC401	Introduction to Mechanical Engineering	1	DE	DE	DE	DE	DE	DE	DE		
MF400	Materials Properties	2	DE	DE	DE	DE		DE			
MF401	Materials Manufacturing	3	DE	DE	DE	DE	DE				
MC402	Mechanics of Materials	4	SA	SA	DE	DE	DE		DE	DE	DE
MF402	Computer Aided Fabrication	4	SA	SA	DE	SA	SA			DE	DE
MC403	Fluid Mechanics	5	SA	SA	SA	DE	DE	DE	DE	DE	DE
MC404	Introduction to Design	5	SA	SA	SA	SA	SA		SA	DE	DE
MC405	Physical Metalurgy	5	SA	SA	SA	EX	SA	SA	SA	SA	SA
MC406	Finite Modeling	6	SA	DE	SA	SA	SA	DE	EX	SA	SA
MC407	Electro-Pneumatic and Hydraulic Systems	6	EX	EX	SA			DE	EX	SA	SA
MC408	Thermodynamics	6	EX	EX	SA	DE	DE	SA	SA	SA	DE
MC409	Design Engineering	7	EX	EX	EX	SA	SA	DE	EX	EX	EX
MC410	Dynamics of Mechanisms	7	EX	SA	SA	SA			EX	EX	EX
MC411	Automation and Control	7	EX	EX	EX	DE	SA	DE	SA	DE	DE
MC412	Mechanical Experimental Analysis	8	EX	SA	SA	EX	SA	DE	EX	EX	EX
MC413	Plant Engineering	8	DE	DE	DE	DE	DE	DE	SA		
MC414	Heat Transfer	8	EX	EX	EX	DE	DE	EX	DE	SA	SA
	Emphasis in Automotive Design Courses										
MC416	Mathematical Models of Mechanical Systems	6	EX	EX	EX	SA	SA	SA	EX	EX	EX
MC417	Materials Engineering	5	SA	DE	SA	SA	SA	DE	EX	SA	SA
MC418	Automotive Conceptual Design	7	EX	EX	EX	SA	SA	SA	EX		EX
MC419	Finite Element automotive applications	8	SA	DE	SA	SA	SA	SA	EX		EX
MC420	Resistance automotive body structures	7	SA	DE	SA	EX	SA	SA	EX		EX
MC421	Automotive prototyping	8	EX	EX	EX	EX	EX	EX	EX		EX
	Emphasis in Aerospace Design Courses										
MC422	Mathematical Models of Mechanical Systems	6	EX	EX	EX	SA	SA	SA	EX	EX	EX
MC423	Materials Engineering	5	SA	DE	SA	SA	SA	DE	EX	SA	SA
MC424	Aerospace Conceptual Design	7	EX	EX	EX	SA	SA	SA	EX	EX	
MC425	Finite Element aerospace applications	8	SA	DE	SA	SA	SA	SA	EX	EX	
MC426	Aerospace Structures	7	SA	DE	SA	EX	SA	SA	EX	EX	
MC427	Aerospace prototyping	8	EX	EX	EX	EX	EX	EX	EX	EX	

It is important to note that, in the case of SLO_ENG3 ("Clear and effective communication in English"), there are curricular elements such as the Advanced Communications in English course (5th semester), and also program level courses offered in English beginning in 5th semester. The development of clear and effective communication in English is developed primarily via the co-curricular ESL program that all students must go through, and which is managed by the English Language Center.

Once the curricular mapping was concluded, the lessons learned during the process are the following:

- Clarity with which each subject relates to each Learning Outcome.
- There is an important amount of involvement and engagement, as well as ownership by faculty members of the Academy that participated in the process.
- Subject content and evaluation criteria were unified.

- Discussion on how students learn and should learn throughout the academic program was achieved among faculty.
- Key moments for the assessment of student learning throughout the academic program were identified.
- Experience was obtained for further program review processes.

3.3 Faculty participating in the program

The program has chairs from Campus, which are full-time professors who are in charge of the program and are involved in the enrollment process and promotion activities, counseling of students and graduate follow-up, program reviews, accreditation projects, etc.:

- Bernardo Valadez - Mexicali Campus.

- Rubén Magdaleno - Tijuana Campus.

Professors who are associated with the program, (most members of the Mechanics Engineering Academy) are:

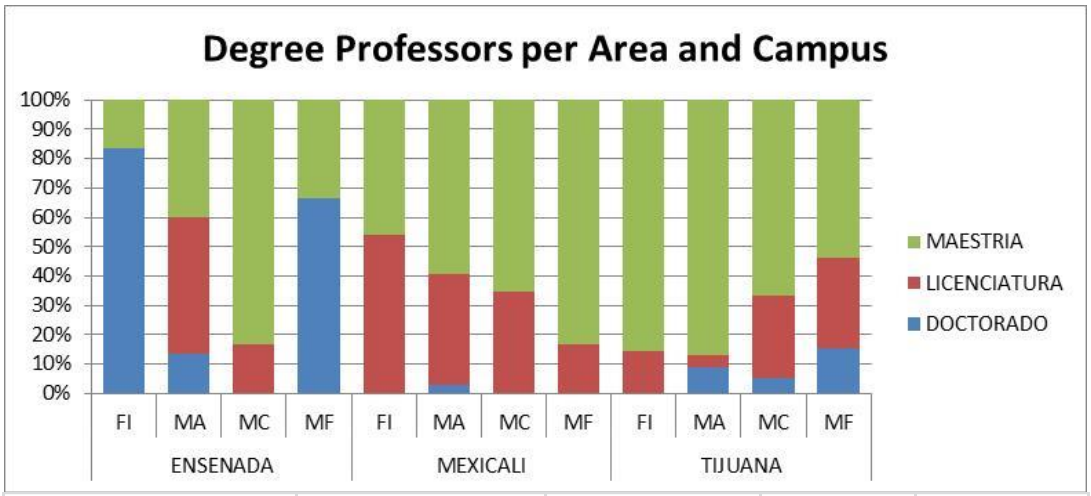
Name	**Academic Degree**	**Knowledge Area**	**Institution**	**Type**	**Campus**
Bernardo Valadez	Doctorate in progress	Mechanical design, Manufacture, Materials, Thermal	CETYS	Full time	Mexicali
Alma Abad	Master's in Science	Materials, mechanical design	CETYS	Part-time	Mexicali
Maribel Lazcano	Master's in Science	Mechanical design, Manufacture	CETYS	Associate* Professors who are part of the administrative staff	Mexicali
Luis Soto	Engineer	Manufacture	CETYS	Adjunct	Mexicali

Yamel Ungson	Master's in progress	Automation systems	UABC	Adjunct	Mexicali
Ruben Yañez	Master's in Science	Mechanical design, Manufacture, Materials, Thermal	ITESM	Adjunct	Mexicali
Jesús Corona	Master's in Science	Aerospace design, Thermal, Fluids	Universidad de Pisa / Universidad Politecnica de Madrid	Associate* Professors who are part of the administrative staff	Mexicali
Enrique Rodarte	Doctor's in engineering	Thermal	Urbana Champaign e Illinois	Adjunct	Mexicali
Iván Pulido	Master's in Science	Mechanical design	ITESM	Adjunct	Mexicali
Iván Williams	Master's in Science	Aerospace design	CETYS	Adjunct	Mexicali
Roberto Salas	Master's in Education	Physics, Thermal	CETYS	Full time	Tijuana
Rubén Magdaleno	Marter's in Science	Mechanics of materials, Manufacture	IPN	Full time	Tijuana
Harvi Castillo	Doctorate in Materials	Materials, Thermal	Universidad Nacional de Colombia	Full time	Tijuana
Esteban Alvarez	Master in Science	Mechanical design	CETYS	Adjunct	Tijuana
Enrique Borja	Engineer	Automation Systems	Universidad de Nuevo León	Adjunct	Tijuana
José Luis Cervantes	Engineer	Aeronautic design	IPN	Adjunct	Tijuana

The following table shows the distribution of professors in the subjects taught in the Mechanic Engineering Program from the previous two semesters:

CODE	SUBJECT	SEMESTER	PROFESSORS		
MA400	Mathematics	1	Mat. Alfredo Rodriguez	Ing. Salvador Baltazar	Ing. Susana Guevara
CC400	Programming methods I	1	Ing. Dania Licea	Ing. Francisco Chavez	Ing. Josefina Becerra
MC401	Introduction to Mechanic	1	Ing. Alma Abad		
MC400	Computer Drawing	2	Ing. Maribel Lazcano	Ing. Alma Abad	Ing. Jorge Dones
MA401	Differential calculus	2	Mat. Alfredo Rodriguez		
CC402	Programming methods II	2	Ing. Francisco Chavez	Ing. Guillermo Cheang	Ing. Josefina Becerra
FI400	Physics I	2	Ing. Diana Navarro	Ing. Salvador Baltazar	Ing. Roberto Hernandez
MF400	Material Properties	2	Ing. Alma Abad	Ing. Eduardo Ávila	
MA402	Integral Calculus	3	Mat. Alfredo Rodríguez	Mtro. Claudio López	
FI401	Physics II	3	Ing. Salvador Baltazar		
MA403	Numerical Methods	3	Ing. Yamel Ungson	Ing. Maribel Lazcano	Ing. Manuel Algravez
MF401	Materials Manufacturing	3	Ing. Maribel Lazcano	Ing. Rubén Yáñez	Ing. Alma Abad
MA404	Probability	4	Ing. Salvador Baltazar	Ing. José Manuel Algravez	
MA407	Differential Equations	4	Ing. Susana Guevara		
FI402	Physics III	4	Mtro. Claudio Lopez	Ing. Yamel Ungson	
MF402	Computer Manufacturing	4	Ing. Maribel Lazcano		
MC402	Mechanics of Materials	4	Ing. Maribel Lazcano	Ing. Rubén Yáñez	Ing. Alma Abad
MA406	Multivariable Calculus	5	Dra. Gabriela Estrada	Ing. Diana Navarro	

MC404	Introduction to Design	5	Ing. Maribel Lazcano	Ing. Alma Abad	
MC403	Fluids Mechanics	5	Ing. Jesus Corona		
MC405	Physical Metallurgy	5	Ing. Bernardo Valadez		
MC406	Modeling Finite	6	Ing. Bernardo Valadez		
MC407	Electro-pneumatic and hydraulic	6	Ing. Ruben Yañez		
MC408	Thermodynamics	6	Ing. Jesus Corona		
MC410	Mechanism dynamics	7	Ing. Ruben Yáñez		
MC411	Automation and Control	7	Ing. Jorge Sosa		
MC403	Engineering Design	7	Ing. Ruben Yañez		
MC412	Experimental Analysis Strain	8	Ing. Bernardo Valadez		
MC413	Plant Engineering	8	Ing. Eduardo Avila		
MC414	Heat Transfer	8	Ing. Iván Williams	Ing. Jesús Corona	Ing. Enrique Rodarte



Tipo_Profesor	(All)			
Nivel2	4			
Sem	(All)			

Count of Cve_Grupo Row Labels	Column Labels DOCTORADO	LICENCIATURA	MAESTRIA	Grand Total
ENSENADA	**9**	**8**	**13**	**30**
FI	5		1	6
MA	2	7	6	15
MC		1	5	6
MF	2		1	3
MEXICALI	**1**	**32**	**52**	**85**
FI		7	6	13
MA	1	14	22	37
MC		10	19	29
MF		1	5	6
TIJUANA	**8**	**19**	**85**	**112**
FI		2	12	14
MA	4	2	40	46
MC	2	11	26	39
MF	2	4	7	13
Grand Total	**18**	**59**	**150**	**227**

3.4 Lines of investigation of the program

CETYS UNIVERSITY's System has many years of research in the fields stated on its Mission: Engineering, Administration and Social Sciences and Humanities. The research is primarily of the applied type, and with a focus on solving problems of the region of Baja California. The cases are reported in the documents that have been delivered to CONACYT to endorse the RENIECYT registration. It has also been documented in the applications and endorsements made by the Institution to belong to the National Register of Quality Postgraduate Programs.

The institution's strategic plan towards the year 2020 (CETYS 2020 PLAN) has several strategies defined in order to strengthen its faculty and research in the institution in order to ensure that this activity is an essential part of their academic functions, and in turn, take this ability to assist in the economic, social and cultural development of the region of Baja California. The three strategies are defined as follows:

(1) Strengthening its faculty through support to develop research activities in some cases, and obtaining doctoral degrees in others.

(2) Recruitment of faculty with doctoral degree and with experience in research and publication of results.

(3) Creation of three Centers of Excellence to conduct research and technology development projects that will significantly impact on the productive, social and cultural sectors of Baja California.

To properly align all research efforts, and in turn, coexist in harmony with the teaching activities, the Institution took on the task of defining a research plan which sets out the guidelines and policies that describe the operational framework of this activity. This plan also sets targets and indicators to be achieved in the short, medium and long term. It stands as one of them, for example, that our faculty members are members of the National Researchers System of CONACYT.

Due to the ordering of research and including its graduate programs in the National Register of Quality Graduate Programs (PNPC for its acronym in Spanish), and encourage research in their careers, the Institution instructed each of its academic areas (Engineering, Business and Administration, and Social Sciences and Humanities) to define their areas of research, as well as organizing its faculty to form academic bodies in each of them. Thus the following lines were established for the area of Engineering:

(1) **Information and Multimedia Technology.** This research line addresses the problems related to the design and development of computer systems applied to process automation and information management using the internet platform and associated technologies. It also addresses the problems of designing the electronic systems required in specialized processes, mainly control. Nine full-time professors are working on this LGAC (4 with Doctoral degree, and 4 in doctoral education). The following academic programs are in this line:

1. Electronic Cybernetics Engineering
2. Computer Science Engineering
3. Digital Graphic Design Engineering
4. Software Engineering
5. Master of Science in Engineering with emphasis in Information and Multimedia Technology.

Design and manufacturing processes. This research addresses the problems related to the design and engineering of products, considering the selection of materials, structural analysis, product testing, as well as the processes required for its manufacture. Six full-time professors are working this LGAC (1 Doctor, and 3 in doctoral training). The following academic programs can be found in this line:

1. Mechanical Engineering
2. Mechatronics Engineering
3. Master of Science in Engineering with emphasis in Design and Manufacturing.

Systems and industrial processes. This research addresses the problems related to the analysis and improvement of processes in the field of production of goods and services, using statistical techniques and operations research as well as methods for quality improvement. Nine full-time professors are working this LGAC (5 doctors and 1 in doctoral training). In this line are the following academic programs:

1. Industrial Engineering
2. Master of Science in Engineering with emphasis in Systems and Industrial Processes.

These lines were defined according to the needs found in the different sectors of the region in which the institution desires to impact with the formation of high-level human resources, and the development of research and technological development. According to the Strategic Plan's indicators, significant progress has been made in strengthening its faculty and considering these LGACs and their specific topics for hiring and doctoral training of the faculty.

Academic bodies are created for each line of research at a system-level, so that professors are integrated to develop research and teaching activities with their respective academic group in both undergraduate and graduate studies. In turn, there are collegiate bodies in the institution for reviewing and monitoring each of its academic programs, the purpose of these groups is the learning assessment, student assessment and periodic review of the academic programs.

3.5 Facilities, laboratories and book collection of the program

All classrooms have projector equipment and wireless Internet connection. Some classrooms have sound equipment. Faculty cubicles have computer and Internet connection.

The library has carried out considerable improvements, especially in the acquisition of electronic books and data bases.

Within the supporting programs we have departments that manage their own resources and strengthen the student's holistic education, such as:

- Student Life is a department that carries out sporting, cultural, and social activities and supports integration and the student body operation.
- Entrepreneurial Development Center promotes the student body participation in the Management and Economic Simulation Exercise program (MESE in Spanish) which strengthens the training for business decision making process through simulators. Coupled to this, the Center promotes the visits to companies and seminars in the institution.
- Student Development Center supports students since before the enrollment process through vocational guidance services, and it accompanies them throughout their undergraduate studies with tutorials, workshops, and psychological guidance.
- English Language Center supports students in the accreditation of TOEFL-equivalent test.

- Computer Services is provided by Information Services that manages computer resources in both software and hardware, as well as the necessary multimedia resources for subject instruction, Blackboard platform, secure Internet access, local network connections, databases, e-mail and videoconference services.
- General Computer Laboratories provide computer resources for general hardware and software use,
  - At Mexicali campus 6 labs.
  - At Tijuana campus 5 labs.
  - At Ensenada campus 5 labs.
- Computer Laboratory to engineering department. This laboratory has computer equipment for students in order to develop trainings by using specialized software focused in the analysis and design of systems associated to mechanic engineering.

In addition, the engineering programs offered by the College of Engineering have the following laboratories by campus:

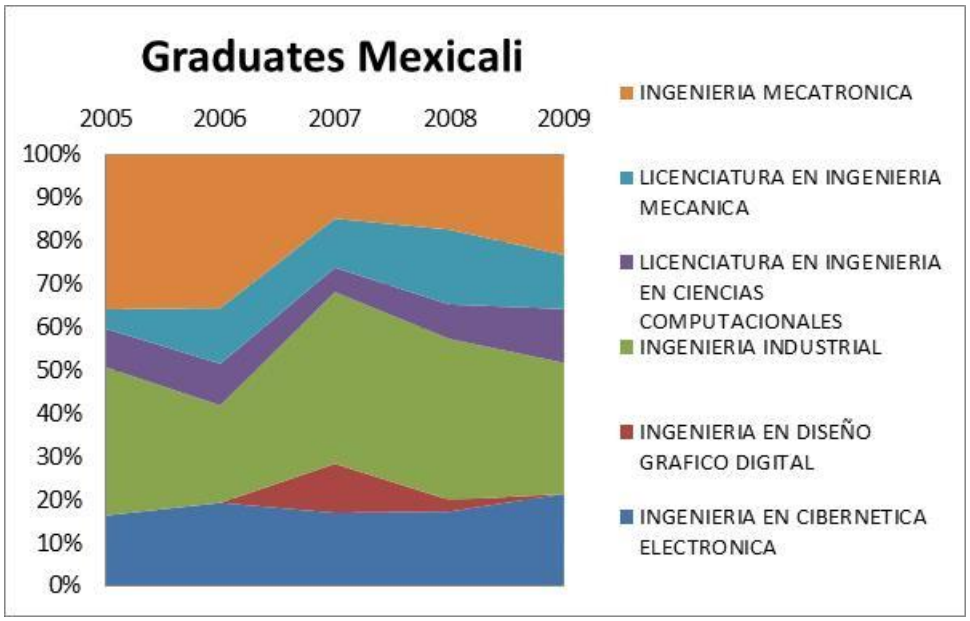
- Mexicali: Physics, Computer Science Engineering Computer Laboratory, Chemistry, Materials and Metallurgy, Thermo fluids, Manufacture, Mechatronics, Production Systems, Processes Laboratory.

- Tijuana: Physics, General Electronics, Manufacture, Mechatronics, Materials and Metallurgy, Production Systems, Industrial Computer labs.

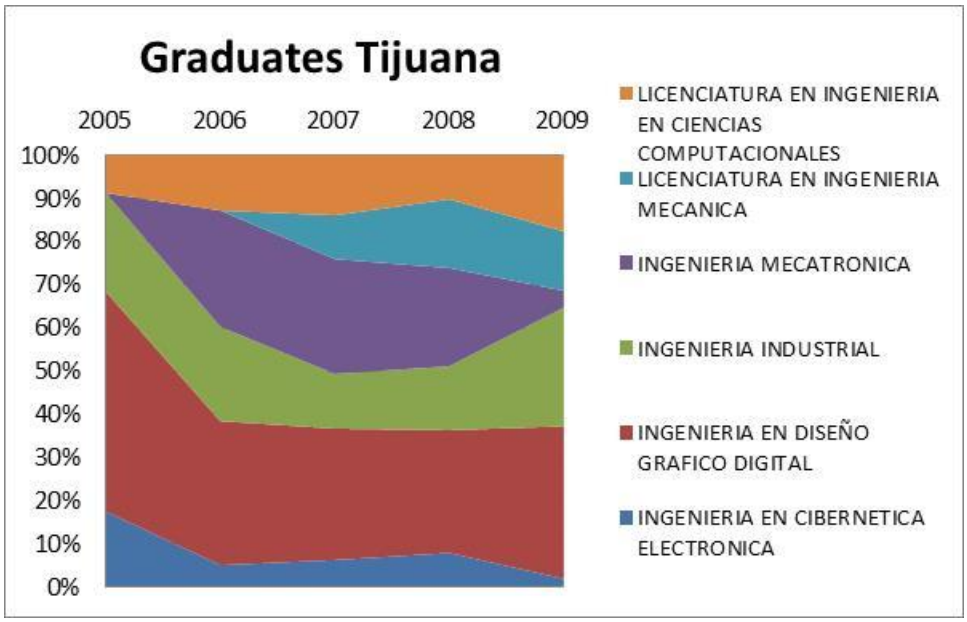
- Ensenada: Physics, General Electronics, Chemistry, Production Systems, Industrial Computer labs.

4. Revision of the program's educational effectiveness

4.1 Graduates of the Program.



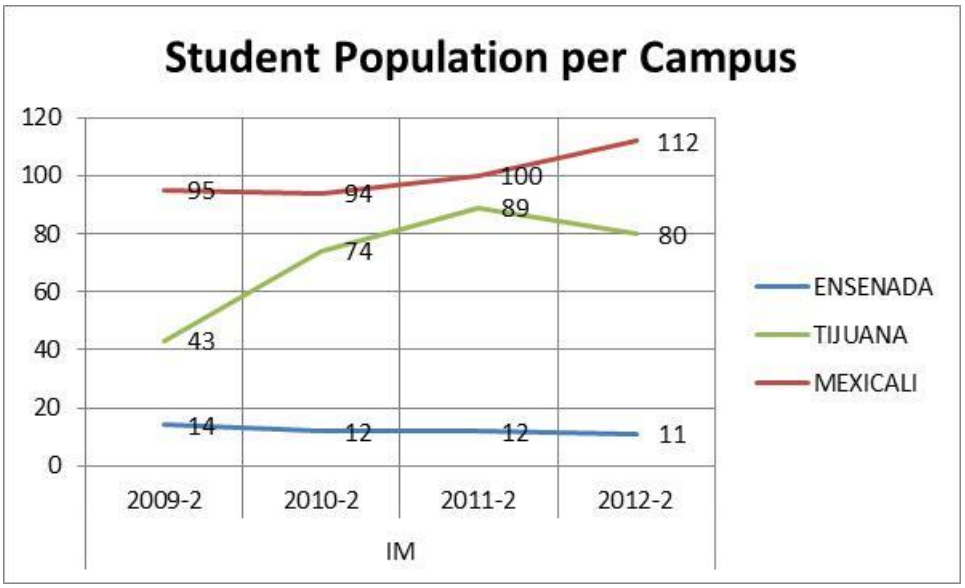
	2005	2006	2007	2008	2009	TOTAL
INGENIERIA EN CIBERNETICA ELECTRONICA	11	12	15	13	12	63
INGENIERIA EN DISEÑO GRAFICO DIGITAL			10	2		12
INGENIERIA INDUSTRIAL	23	14	35	28	17	117
INGENIERIA MECATRONICA	24	22	13	13	13	85
LICENCIATURA EN INGENIERIA EN CIENCIAS COMPUTACIONALES	6	6	5	6	7	30
LICENCIATURA EN INGENIERIA MECANICA	3	8	10	13	7	41
Escuela	67	62	88	75	56	



	2005	2006	2007	2008	2009	TOTAL
INGENIERIA EN CIBERNETICA ELECTRONICA	**10**	**4**	**5**	**7**	**1**	**27**
INGENIERIA EN DISEÑO GRAFICO DIGITAL	**29**	**26**	**24**	**25**	**18**	**122**
INGENIERIA INDUSTRIAL	**13**	**17**	**10**	**13**	**14**	**67**
INGENIERIA MECATRONICA	**0**	**21**	**21**	**20**	**2**	**64**
LICENCIATURA EN INGENIERIA EN CIENCIAS COMPUTACIONALES	**5**	**10**	**11**	**9**	**9**	**44**
LICENCIATURA EN INGENIERIA MECANICA	**0**	**0**	**8**	**14**	**7**	**29**
Escuela	**57**	**78**	**79**	**88**	**51**	

4.2 Student Population

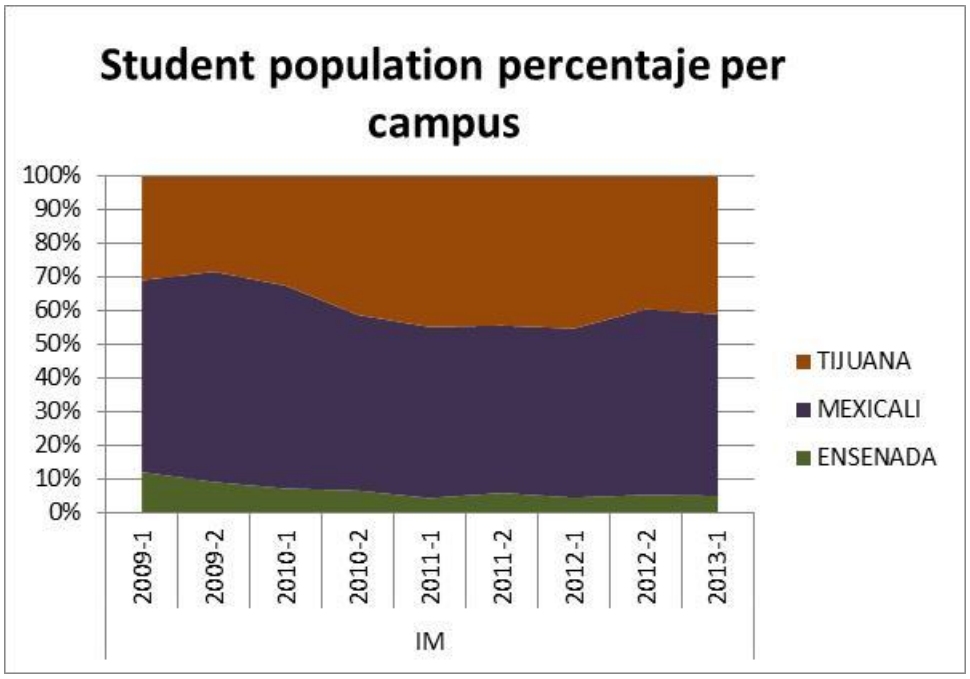
The student population trend of the Mechanical Engineering program for the three campuses is shown in the following chart:



Sum of textbox2	Column Labels			
Row Labels	ENSENADA	MEXICALI	TIJUANA	Grand Total
IM				
2009-2	14	95	43	152
2010-2	12	94	74	180
2011-2	12	100	89	201
2012-2	11	112	80	203

As shown in the data for the Mexicali Campus, the student population has been gradually increasing, while in the Tijuana campus in the 2012-2 cycle, the population decreased compared to the previous cycle.

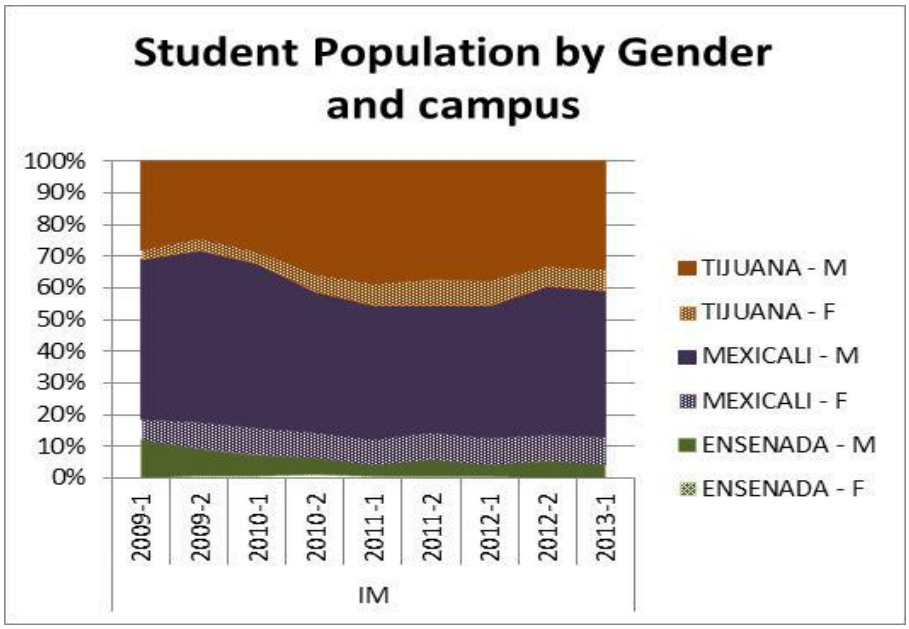
In the Ensenada we can see a reduction. Note that the Mechanical Engineering program for the Ensenada campus does not include all semesters.



Sum of textbox2	Column Labels			
Row Labels	ENSENADA	MEXICALI	TIJUANA	Grand Total
IM				
2009-1	13	61	33	107
2009-2	14	95	43	152
2010-1	11	91	49	151
2010-2	12	94	74	180
2011-1	8	91	80	179
2011-2	12	100	89	201
2012-1	9	99	89	197
2012-2	11	112	80	203
2013-1	9	95	72	176

As shown in the previous chart, the most students of Mechanical Engineering are from the Mexicali Campus.

In the Tijuana campus we can locate around 40% of the total population and in approximately 10% in the Ensenada Campus.



Nombre_Departamento	DE INGENIERIA					
Sum of textbox2	**Column Labels**					
	ENSENADA		**MEXICALI**		**TIJUANA**	
Row Labels	**F**	**M**	**F**	**M**	**F**	**M**
IM						
2009-1		13	7	54	3	30
2009-2	1	13	13	82	6	37
2010-1	1	10	13	78	6	43
2010-2	2	10	14	80	10	64
2011-1	1	7	14	77	11	69
2011-2	1	11	17	83	14	75
2012-1	1	8	16	83	15	74
2012-2		11	17	95	13	67
2013-1		9	14	81	12	60

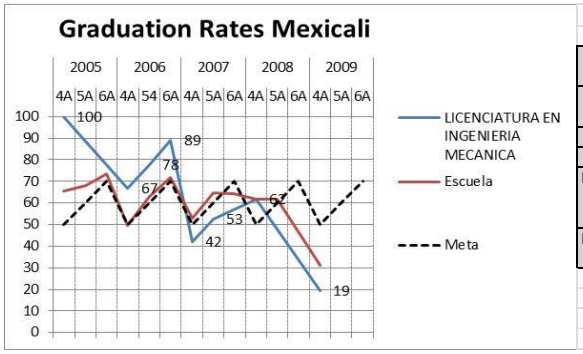
The gender behavior over time in the Mexicali and Tijuana campuses has behaved roughly stable. The female population represents about 10% of all students in both campuses.

In the Ensenada Campus gender behavior is stable; it is observed that the entire population is male.

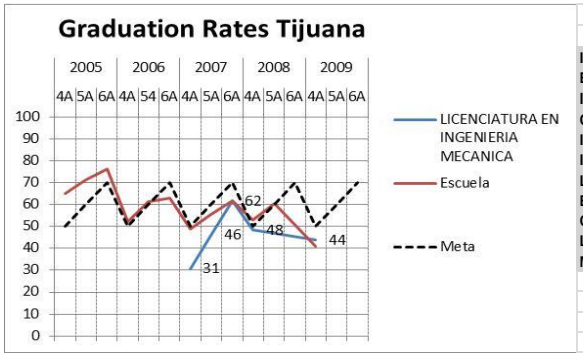
4.3 Analysis of retention and graduation rate

The retention analysis shown below is only for the Mexicali and Tijuana Campuses, since the complete program is offered only in these campuses.

Students enrolled in the Ensenada Campus must move to any of the two campuses (Mexicali or Tijuana) to complete their curriculum from the fifth semester.



	2005			2006			2007			2008			2009		
	4A	5A	6A	4A	54	6A	4A	5A	6A	4A	5A	6A	4A	5A	6A
INGENIERIA EN CIBERNETICA ELECTRONICA	60	67	73	50	61	67	72	83		88			40		
INGENIERIA EN DISEÑO GRAFICO DIGITAL										35	50		18		
INGENIERIA INDUSTRIAL	70	85		44	48	52	63	71	73	62	67		55		
INGENIERIA MECATRONICA	66	75		54	73	85	67	72		63	68		30		
LICENCIATURA EN INGENIERIA EN CIENCIAS COMPUTACIONALES	31	46		33	56	67	22	44	56	60			25		
LICENCIATURA EN INGENIERIA MECANICA	100			67	78	89	42	53		62			19		
Escuela	65	68	73	50	63	72	53	65	64	62	62	###	31	##	##
Meta	50	60	70	50	60	70	50	60	70	50	60	70	50	60	70



	2005			2006			2007			2008			2009		
	4A	5A	6A	4A	54	6A	4A	5A	6A	4A	5A	6A	4A	5A	6A
INGENIERIA EN CIBERNETICA ELECTRONICA	75	83		44		56				31	54		17		
INGENIERIA EN DISEÑO GRAFICO DIGITAL	71	74	76	54	62	67	57	69		63			72		
INGENIERIA INDUSTRIAL	80	87		60	64	68	50	56		62			61		
INGENIERIA MECATRONICA				56		62	59		62	64	71		13		
LICENCIATURA EN INGENIERIA EN CIENCIAS COMPUTACIONALES	33	42		47	59		48	52		50	56		40		
LICENCIATURA EN INGENIERIA MECANICA							31	46	62	48			44		
Escuela	65	71	76	52	61	63	49	56	62	53	61	###	41	##	##
Meta	50	60	70	50	60	70	50	60	70	50	60	70	50	60	70

As it can be seen in the graph to Mexicali Campus, the Mechanical Engineering program presented a graduation rate above the general behavior target of the engineering school for generations 2005 and 2006. However, the class of 2007 shows a decrease in relation to the expectations; this is probably related to the fact that there was a change in the curriculum program that included a larger number of subjects due to the inclusion of specialties.

Except for the class of 2007, Mexicali has been presenting a graduation rate higher or equal to the standard of engineering school, but for the last generation, 2009, there was a significant drop in the rate for both the school and for the mechanical engineering program. This last fact should lead to a deeper analysis regarding the causes that led to such a fall.

Regarding Campus Tijuana, only the second-generation graduated and have approached the standard expected in both the first and last generation that is below the standard.

4.4 Learning Assessment Process

The rest of this section will focus on the assessment plan and program developed to assess program level learning outcomes.

Assessment at the program level is something new, due to the fact that the focus has been on developing an infrastructure of knowledge and resources, as well as culture, to support assessment at the institutional level. The result of these efforts, as well as the information that has been generated is just now being used to obtain indicators for program review.

At the program level, the College of Engineering decided to designate an Assessment Officer to design a pilot assessment plan and program for the August-December 2010 semester for all Engineering Programs offered by the College. The responsible for this process was M.S. Jorge Sosa López, with the collaboration of the Deans of the Schools of Engineering and Chairs of each Academy.

This pilot project is divided into two stages, the first was deployed during the second semester of 2010 and focuses on program level learning outcomes common to all engineering program. The second stage focuses on program level outcomes specific to the academic program, in this case the Bachelor in Mechanical Engineering, as well as external assessment data relating to the EGEL exit test administered by CENEVAL.

This assessment plan has the goal to not only define a structure and methodology for assessment at the program level for the College of Engineering, that can be integrated as seamlessly as possible to the academic dynamic of the subjects offered by the College of Engineering, but also with a strong faculty participation in the design of the assessment plan and process, providing a case study that not only integrates what has been achieved by the institutional process, but builds upon it. The complete documentation regarding the Assessment Plan for the College of Engineering may be found in the corresponding document, separate from this program review document

To assess the program level specific outcomes the following stages were defined:

1. Definition of rubrics.
   Faculty for each campus will define a proposal of the type and format for the rubrics to be applied during the semester. These proposals are analyzed by the Academy as a group and validated for use.

2. Definition of period for assessment.
   At the beginning of each semester, the Academy will define which rubrics will be applied during the semester.

3. Identification of subjects where assessment will be applied.
   Based upon the curricular mapping for the academic program, subjects are selected for assessment.

4. Notification to faculty involved in assessment activities.
   Faculty is notified and trained in the use of the rubric if necessary.

5. Definition of learning activities and evidence.

Faculty selects learning activities and evidence for assessment, according to the selected subject and curricular mapping.

6. Students upload their work to the electronic portfolio during the semester.
   Students do the assigned learning activity and upload their work to the electronic portfolio.

7. Faculty evaluates and provide feedback to students.
   Faculty evaluates student work using the previously designed rubrics and provides feedback to the students, as well as a general summary of assessment results.

8. Faculty generates a summary of assessment results.
   Each faculty member generates a summary of assessment results for student learning based upon the selected subject and rubric.

9. The Academy analyzes the summary of assessment results.
   The Academy analyzes assessment results as a group, identifying areas of opportunity and improvement. If expected learning is not achieved, then an action plan is defined. The analysis of assessment results seeks to answer the question: what does this data mean with regards to student learning

The College of Engineering began implementing the program review process in 2010 in all its academic programs. From its beginning and until the second half of 2012, the learning outcomes that were evaluated are those that apply to all engineering programs, being the SLO_ENG2 the one evaluated in the semester of 2012-2.

The learning outcomes assessment of the Mechanical Engineering program began in the first half of 2013 (January-June 2013), under the following procedure:

1) Selection of the Learning Outcomes: The Academy decided that, for this cycle, learning assessment SLO_IM1 will be applied.

2) Selection of subjects for evaluation: Based on the range of subjects offered for the semester from January to June 2013, 6 subjects from the mechanical engineering program were selected for evaluation.

CODE	SUBJECT	SEMESTER	PROFESSORS

MF400	Materials Properties	2	Alma Abad Tizoc Huerta
MC421	Automotive Prototyping	8	Ruben Yañez Alfredo Zavala
MC427	Aerospace Prototyping	8	Jesús Corona Jose Cervantes

3) Training of faculty: a group of professors who teach the subjects to participate in the evaluation cycle were trained.

4) The assessment during the semester: The assessment cycle was deployed during the semester from January to June 2013 and the results, including evidence of learning, were uploaded to the Electronic Portfolio. The summary of the learning assessment results is with the coordinator.

5) Analysis of results: The results were analyzed by each academy during the second half of 2013 and have been integrated into the documentation of the program review.

4.5 Learning Assessment Outcomes

Much work has been done at the institutional level with regards to Assessment. An assessment plan and program began in 2008 with a focus on the gradual and systematic assessment of all institutional level learning outcomes for all academic programs. This has been a work in progress, in which areas of improvement have been identified and addressed, such as faculty participation and the integration and use of the electronic portfolio.

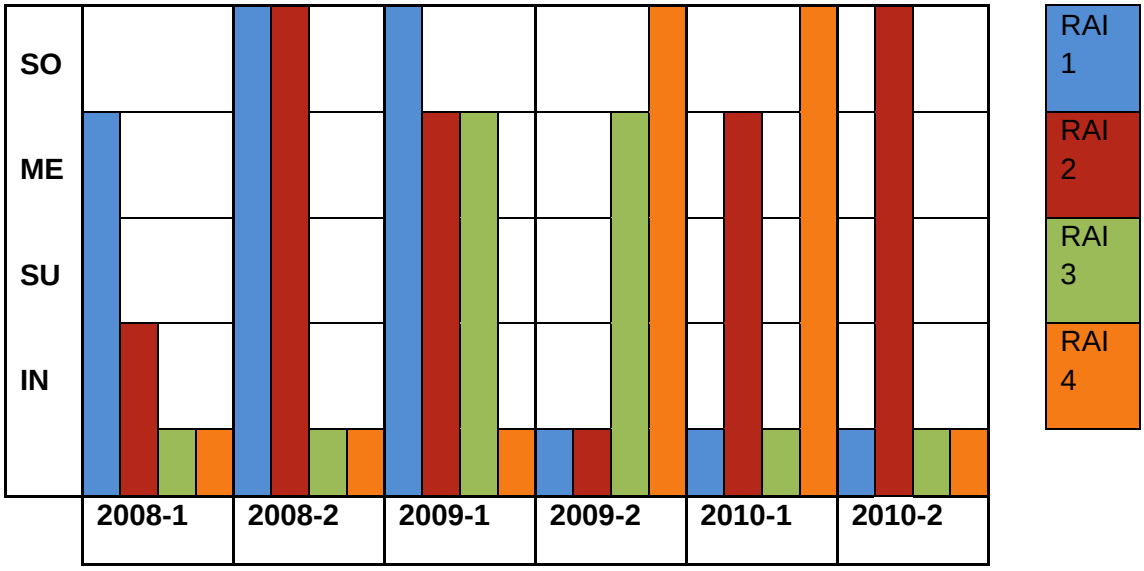
The institutional assessment process now gathers and stores information via the electronic portfolio, which is a custom design, developed by the Information Technologies Department of CETYS University.

The results of the assessment of institutional learning outcomes are delivered to the Deans of the Schools of Engineering at the end of each assessment cycle, which are by semester. The academies use this information as general input for the program review process.

INSTITUTIONAL ASSESSMENT RESULTS.

The results presented to the Academy by the CDMA (Center for Academic Development and Improvement) in the “Institutional Assessment Report Summary” are as follows:

Assessment Results (Mode)



Where: IN = Insufficient
SU = Sufficient
ME = Improvable
SO = Outstanding

RAI1 = Clear and effective communication in Spanish
RAI2 = Continuous learning
RAI3 = Critical thinking
RAI4 = Cultural diversity.

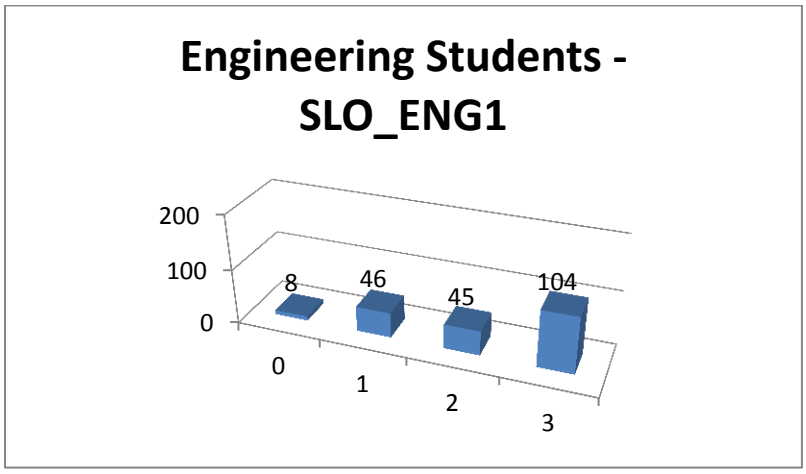
In general terms, the assessment results show a variation in learning achievement levels in each of the four institutional learning outcomes, without achieving outstanding or improvable levels consistently. This may be due to various factors that should be analyzed in conjunction with the Centers for Student Development (CEDEs) of each Campus.

Work has been done to support student development through the CEDEs of each Campus, due to the diverse academic achievement profiles of our students. This is done via workshops and student monitoring in conjunction with the academic coordinators. However, the academy identifies the importance of the subject offering and content for fundamental areas relating to the four institutional learning outcomes.

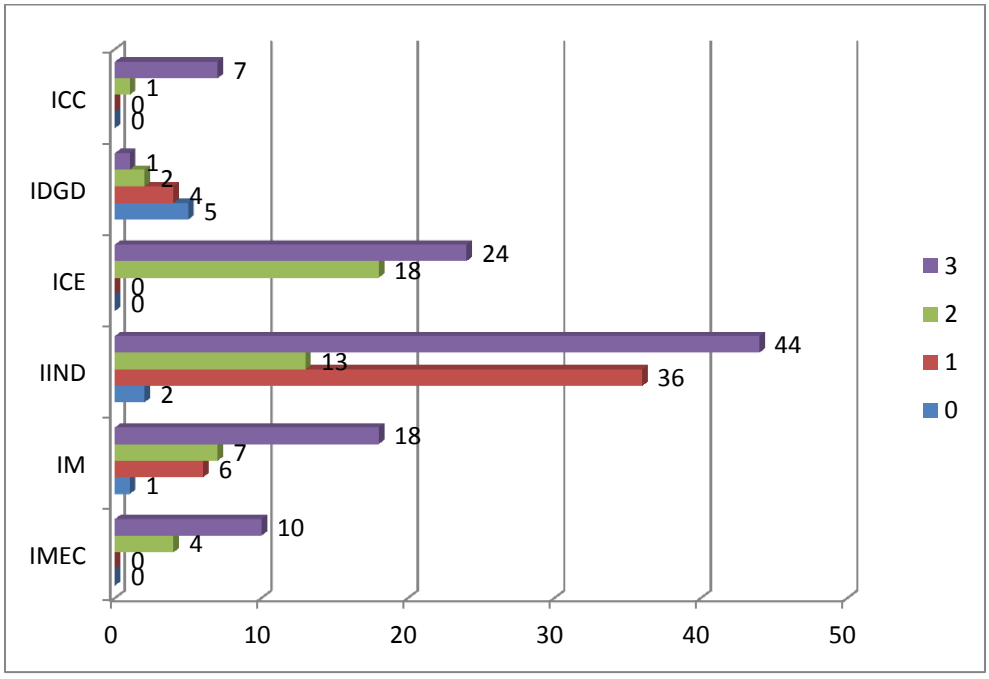
Also, the Academy identifies a need to disaggregate data for each academic program to provide program specific information regarding institutional assessment for program review purposes.

PROGRAM ASSESSMENT RESULTS.

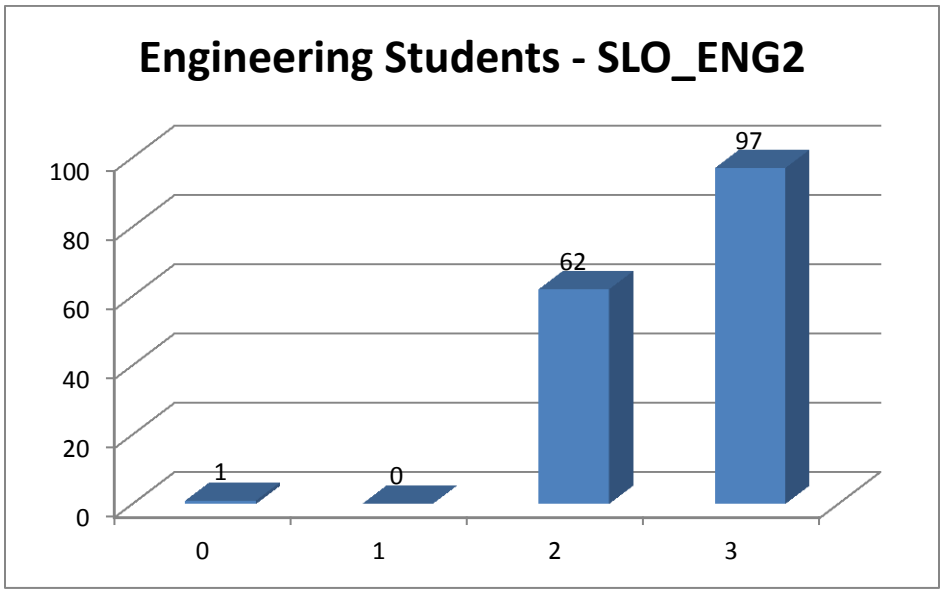
With regards to SLO_ENG1 (… problem solving…), in general, 74% of engineering students obtained learning achievement levels of 2 or 3 (Reinforcement/Improvable, Evaluation/Outstanding):



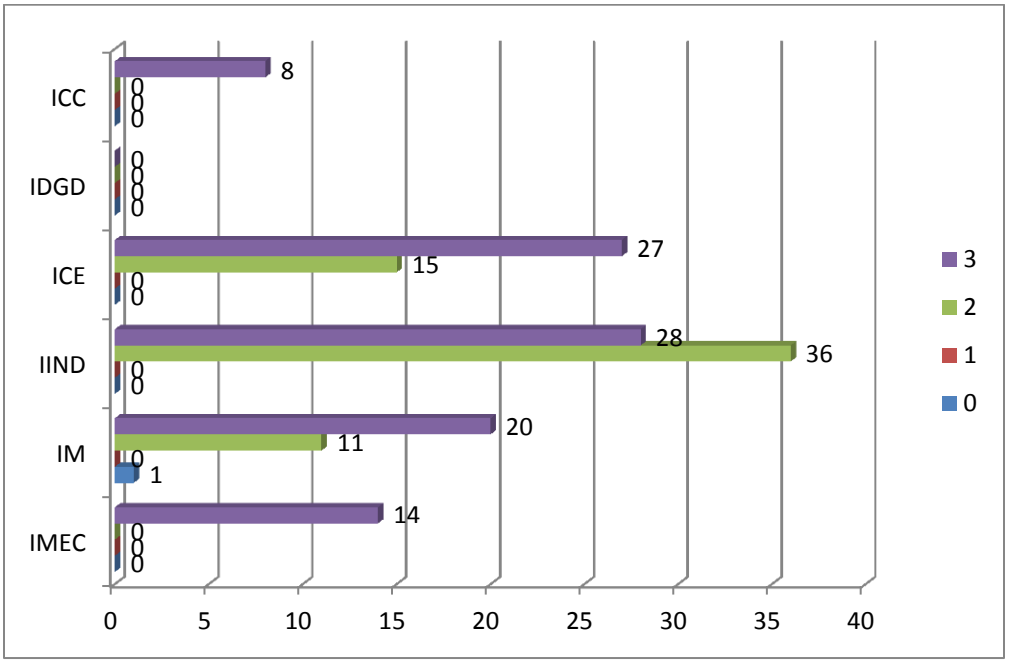
For this same learning outcome (SLO_ENG1), Mechanical Engineering students, 78.13% obtained learning achievement levels of 2 or 3 (Reinforcement/Improvable, Evaluation/Outstanding):



With regards to SLO_ENG2 (… project management…), in general, 99.3% of engineering students obtained learning achievement levels of 2 or 3 (Reinforcement/Improvable, Evaluation/Outstanding):



For this same learning outcome (SLO_ENG1), Mechanical Engineering students, 97% obtained learning achievement levels of 2 or 3 (Reinforcement/Improvable, Evaluation/Outstanding):



For the January-June cycle of 2013, the learning assessment process focused on assessing Learning Outcome Program designated as SLO_IM1, this was assessed in three different subjects taught in Mexicali and Tijuana campus.

The trend of the results obtained in each subject for all students who were tested, are shown in the following table:

Subject	**Assessment results (MODE)**
Materials Properties	Level 2 = In process (DE) (It is equivalent to Sufficient scale based on Institutional assessment)
Automotive Prototyping	Level 3 = Exemplary (EX) (Equivalent to outstanding performance based on Institutional assessment)
Aerospace Prototyping	Level 3 = Exemplary (EX) (Equivalent to outstanding performance)

The results correspond to the level expected in the program curriculum map that appears in 3.2.

4.6 Improvement actions derived from the learning assessment

As a result of the analysis of the global summary of assessment results, the academy came to the following conclusions and areas of opportunity:

- The results were consistent in both the Mexicali and Tijuana Campuses.
- The results are acceptable and are congruent with student learning expectations according to the current curricular mapping done for the academic program.
- We found the need to standardize the assessment process of learning outcomes of the program and to include the three campuses in measuring those results.
- Based on the need found, the Academy developed a learning assessment plan that will begin in August 2013.
- The plan provides that each program learning outcome should be measured considering subjects who develop that result in different levels: *In process* (DE-en DESARROLLO), satisfactory (SA-SATISFACTORIO) and exemplary (EX-EJEMPLAR).
- To comply with the above, the academy agreed that each learning outcome should be measured in at least one subject for each level.
- The assessment plan learning outcomes of program is described in the document, and it is found in the attachments section.
- The program assessment plan will be carried out in parallel with institutional and engineering assessment plans, in order to obtain short-term feedback and to establish improvement actions.

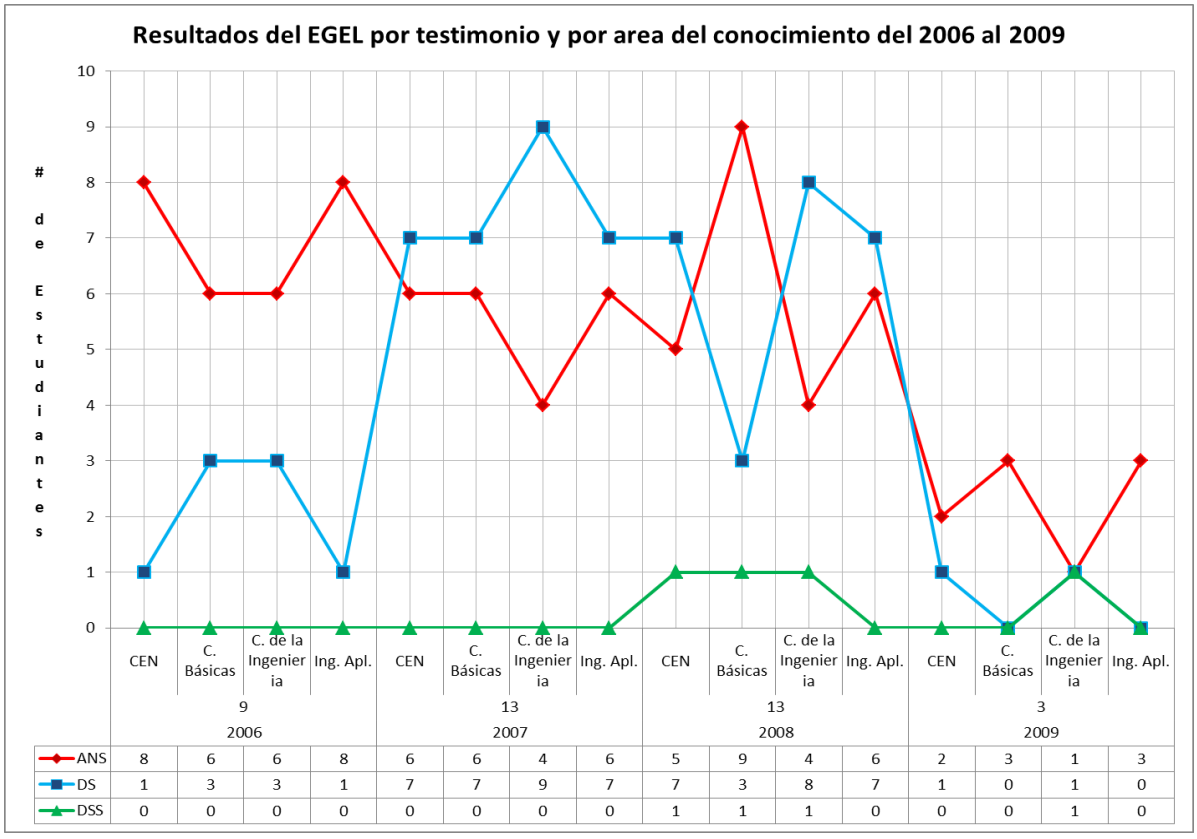
- The improvements resulting from the learning assessment results will impact restructuring programs, changes in infrastructure and convenient actions to achieve the learning outcomes set by the program.

4.7 Student performance in CENEVAL's EGEL.

Institutional purpose of CETYS is that all students take an assessment test by an independent entity to determine a metric that indicates how efficient they are for graduating to the professional field.

Below are three graphs and a comparison chart, based on a sample of generations between the years 2006 to 2013 where total graduate students apply it and depending on the rate of correct answers are determined as ANS (Still Not Satisfactory), for those who do not reach a score of 1000 points. DS (Satisfactory Performance) for greater than and equal to 1000 but less than 1150 and as DSS (Outstanding Performance) for those students get greater or equal to 1150 points.

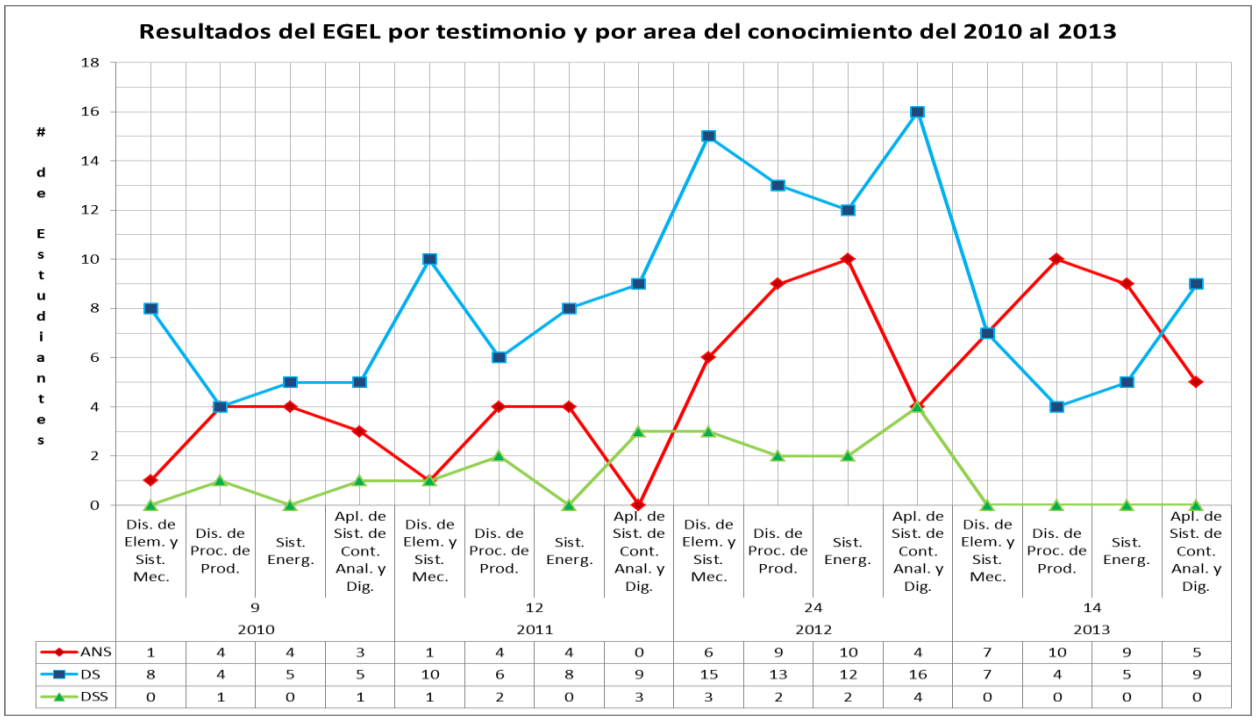
The first chart shows how many students achieve scores by area of knowledge since 2006.

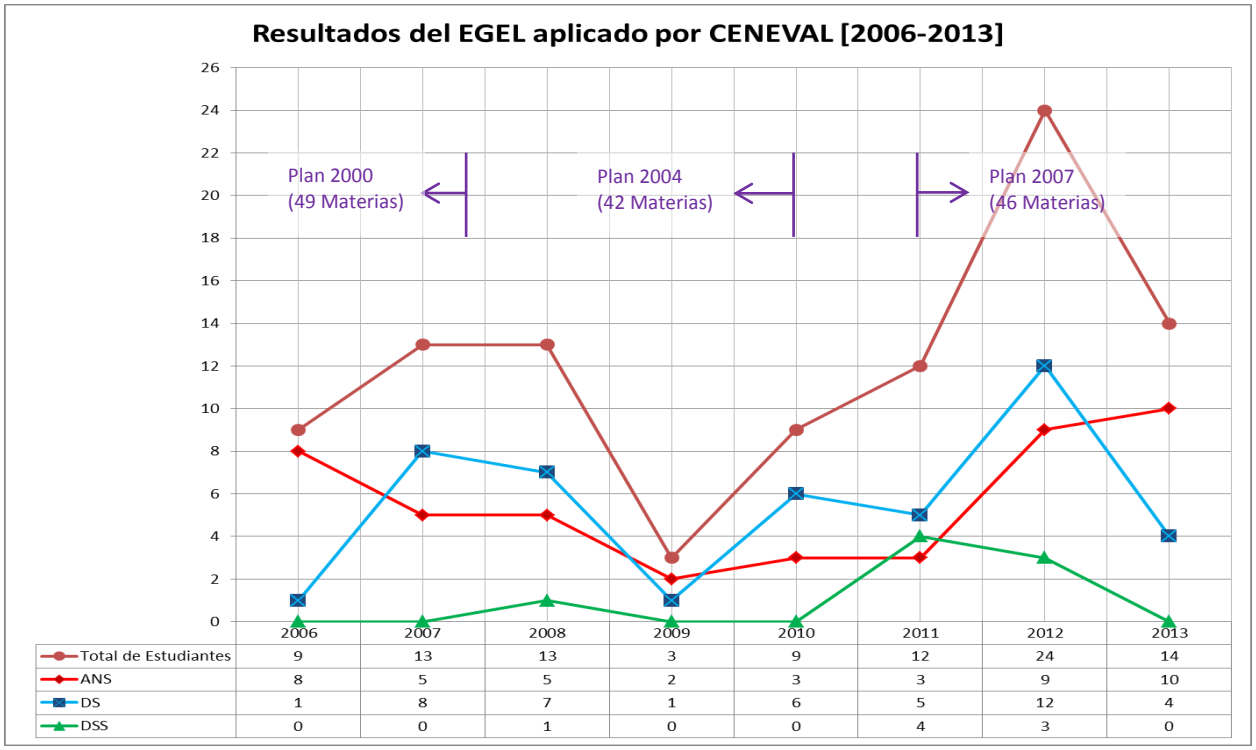


	CEN	C. Básicas	C. de la Ingeniería	Ing. Apl.	CEN	C. Básicas	C. de la Ingeniería	Ing. Apl.	CEN	C. Básicas	C. de la Ingeniería	Ing. Apl.	CEN	C. Básicas	C. de la Ingeniería	Ing. Apl.
	9				13				13				3			
	2006				2007				2008				2009			
ANS	8	6	6	8	6	6	4	6	5	9	4	6	2	3	1	3
DS	1	3	3	1	7	7	9	7	7	3	8	7	1	0	1	0
DSS	0	0	0	0	0	0	0	0	1	1	1	0	0	0	1	0

It can be seen that for the 2013 class there are not students with **DSS** scores. Students who got scores of **DS** increased and students who did not get minimum scores of **ANS** continues. What is desirable is to increase **DSS** and **DS** scores and reduce **ANS** scores.

In te second chart the characteristics of EGEL by area of knowledge were modified by CENEVAL since 2010. It is observed that the number of students who get **DS** increased; we have less quantity of **ANS** scores and few with **DSS** scores. In fact in the immediate last semester of May 2013, it was a regression.





In this third chart is observed trend of all global scores with established criteria by CENEVAL since 2006 to 2013.

Academically there are effects that have direct influence, these are the contents of each subject and the number of subjects, such as the 2000 plan had their last graduates in 2007 (with 49 subjects), the 2004 Plan (with 42 subjects) evaluated graduates from 2008 to

2010 and the 2007 Plan (with 46 and 2 specialty materials, automotive and aerospace) evaluated since 2011, as indicated by the notes on the third graph, there are other influencing factors such as overall student achievement during their career, the compatibility of the areas examined (nationally) with the learned and required locally; these are factors that are required to observe in institutional self-study.

The values of the third chars are obtained from the next table:

Year	Total Students	ANS	DS	DSS	NA
2006	9	8	1	0	0
2007	13	5	8	0	0
2008	13	5	7	1	0
2009	3	2	1	0	0
2010	9	3	6	0	0
2011	12	3	5	4	0
2012	24	9	12	3	0
2013	14	10	4	0	0
	97	45	44	8	0

Year	Total Students	ANS %	DS %	DSS %	NA %

2006	9	89	11	0	0
2007	13	38	62	0	0
2008	13	38	54	8	0
2009	3	67	33	0	0
2010	9	33	67	0	0
2011	12	25	42	33	0
2012	24	38	50	12	0
2013	14	71	29	0	0
	97	45	44	8	0

The results shown in the table, suggest that all the areas that make up the exam are critical to strengthen. All this is based on that we want to bring our graduates to have outstanding performance in all areas.

4.8 Program accreditations and recommendations

The Mechanical Engineering program is accredited by the Board of Engineering Teaching Accreditation CACEI (*in Spanish: "Consejo de Acreditacion de la Enseñanza de la Ingenieria"*), since 2005 and a second re-accreditation in 2012. The recommendations from this organization are:

1.- Increase equipment of the Physics, Thermo fluids and Materials laboratories according to the requirements in the curriculum related to practical aspects.

2. Manage the expansion of the spaces assigned for the Physics, Manufacture, Materials and Thermo fluids laboratories, as well as implement safety measures in all laboratories servicing the program.

3.- Increment and update the bibliographic collection and the number of copies per title, according to what is established by CACEI.

4.- Increment the number of research and/or technological development projects with student participation.

5. Establish efficient mechanisms that allow professors to promote.

4.9 Follow up on the accrediting bodies' recommendations

Currently, a plan is being developed to address the recommendations made by CACEI to the program. In addition to this plan, it is important to note that the construction activities of the building for the Center of Excellence in Design and Innovation are about to begin. The School of Engineering and several additional laboratories will be located in this building. It is also important to mention that CONACYT-EMPRESA projects are being developed with the participation of students and faculty of the program.

4.10 Faculty productivity

Faculty of the College of Engineering, in addition to their work as professors, carry out various scientific researches related to research lines in: manufacturing, aerospace design, renewable energy, software development. These research areas have been defined as part of the needs identified in the 20-20 plan of CETYS University System. The results of these research projects are published in articles by professors in conferences, articles in journals and books.

Another important activity of the faculty is industry-related projects which most times are funded through the stimulus for innovation awarded by organizations such as CONACYT. These projects arise from innovation needs of the Industry to improve their products and / or manufacturing processes, these Companies go to CETYS asking for support in the specialty areas of the University.

The services required to the Institution are basically giving technical consultancy to develop engineering projects such as making an innovation. The results of these investments are documented as technical reports, which describe that participation involved with the company, main activities and results obtained.

It is important for CETYS that professors are continually conducting research, publishing and participating in projects linked to the industry. For this reason, CETYS supports and recognizes professors for their productivity. The support provided to professors, who conduct research and publish, consists in giving a balance in the quantity of subjects assigned, one less subject than normal (four instead of three subjects); so professors have the time to publish and conduct research.

Each year CETYS University launches a call with different categories to invite professors to participate in the award given to those with more publications, research and partnership activities with the industry.

The faculty productivity is considered in the following aspects:

-Publications: articles in conferences, articles in journals, books

-Participation in projects in partnership with the Industry

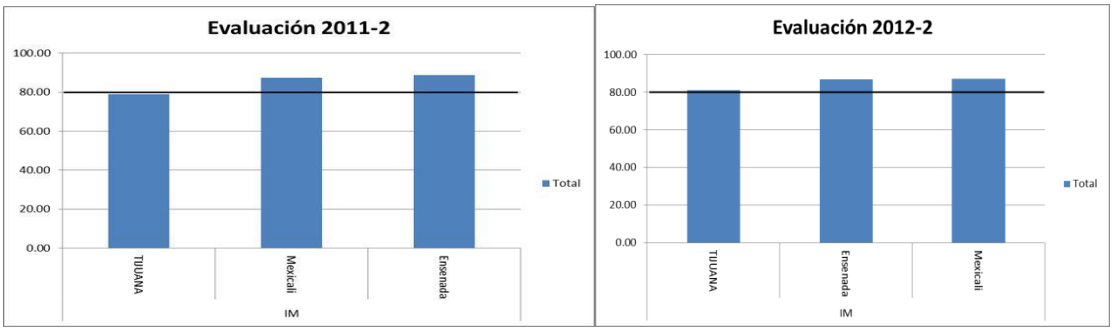
-Certifications and trainings

-Patents

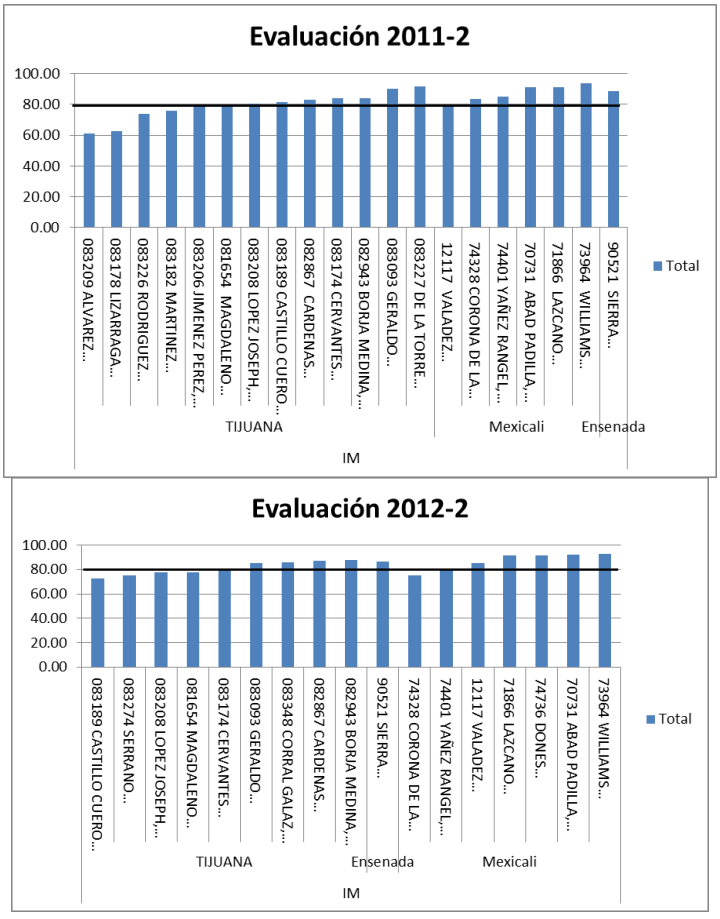
- SNI Level (National System of Researchers).

4.11 Faculty evaluation

Evaluations presented are collected from the Professor Evaluation System, and the last two semesters are displayed as a sample, from August to December, 2011 and 2012. As it is shown in the chart, the overall level has an evaluation of 8 out of 10 as a minimum, which is the Tijuana campus. Overall it is a good evaluation.



When analyzing professor evaluations we can see that there are opportunities for improvement in some of them that are below the standard, of at least 8 out of 10. To help professors who get low scores, there is a “Teaching Improvement Program” to which professors are invited to attend it.



5. External revision of the program

5.1 Academic profile of the external reviewers

The external reviewers who evaluated our review of the program are:

- **Maj Dean Mirmirani and**
- **Behrouz A. Aslani**

Their academic profiles are the following:

Maj Dean Mirmirani:

EDUCATION

PhD	Mechanical Engineering, University of California, Berkeley, 1977
MS	Mechanical Engineering, University of California, Berkeley, 1971
BS	Mechanical Engineering, Tehran Polytechnic, 1969

EMPLYMENT HISTROY

October 2007 - present	Dean and Professor, College of Engineering, Embry-Riddle Aeronautical University, Daytona Beach, FL
2007 – present	Professor Emeritus, California State University, Los Angeles
1981 - 2007	Professor, Department of Mechanical Engineering, California State University, Los Angeles Department Chair, 1992 – 1998, and 2001 – 2007
1980 - 1981	CF Brun and Company, Alhambra, CA, Senior Engineer
1979 - 1980	Academic Visitor, Department of Electrical Engineering, Imperial College of Science and Technology, London, UK
1977 - 1979	Senior Analyst, Industrial Management Institute, Tehran, IranAdjunct Professor, Department of Electrical and Systems Engineering, National University, Tehran, Iran

Behrouz A. Aslani:

EDUCATION

STANFORD UNIVERSITY, Stanford, California
Ph.D. in Industrial Engineering (now Management Science and Engineering)

- Ph. D. Thesis "Sequential Linear Programming Under Uncertainty in the Operation of Multi-Purpose Dam-Reservoir System: Case Study Khuzestan, Iran".

Plus Dual Masters of:

- ***M.A. in Economics***
- ***M.S. in Industrial Engineering(now Management Science and Engineering)***

ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE, Lausanne, Switzerland
Civil Engineering Diploma

TEACHING AND CONSULTING

Illinois State University, Office of International Studies, Normal, Illinois (summers) 2005- Present

CALIFORNIA STATE POLYTECHNIC UNIVERSITY, Pomona, California
Emeritus Professor, College of Business Administration, *taught 1989-2007*

CETYS Universidad, College of Business Administration, Mexicali, Mexico *2005-Present*

Faculty Associate, Office of Research and Sponsored Programs, *2002-2003*

Special Consultant for Armenia, *1996-1997*

Chapman University, College of Business, Orange, California *1994-1996*

University of Connecticut, Storrs and Hartford campuses, *(summers) 1991-1995*

University of Pittsburgh, Office of International Studies and Programs, *1994-1995*

International Project Manager, International Center *1996-2002*

Cameroon Agricultural Policy & Planning Training Director, *1989-1994*

Internationalization of California State Polytechnic University, *1991- 1993*

5.2 Recommendations of the external reviewers

Review of the Bachelor in Mechanical Engineering

To:
Dr. Miguel Salinas
Dean School of Engineering
CETYS University
Mexicali, B.C.
Mexico

From:
Behrouz Aslani, Ph.D.

Professor Emeritus, California State University and Polytechnic, Pomona, and
Maj Mirmirani, Ph.D.
Dean, College of Engineering & Professor of Mechanical Engineering, Embry-Riddle Aeronautical University, Daytona Beach

August 11, 2013

Subject: External Evaluation of the Bachelor of Science in Mechanical Engineering

Dear Dr. Salinas:

Thank you for the opportunity to review the Bachelor of Science in Mechanical Engineering program at CETYS. We have reviewed the Program Review 2013 document and subsequently participated (Dr. Mirmirani via video conferencing) in the August 8th , 2013 meeting and presentation held at the faculty of Mechanical Engineering -CETYS Mexicali campus. The faculty members present were: Ms.Alma Abad, Ms. Maribel Lazcano Camacho, Mr. Jesus Corona, Mr. Jorge Sosa, Dr. Miguel Salinas, Mr. Ruben Yenez Rangel, and Mr. Bernardo Valdez-Rivera. We also had a chance to interview Mechanical Engineering students, Armando Fernandez Mercado, Sorgia Lopez Garcia, Vanessa Salcedo, and Manuel Hernandez V.

We are pleased to submit herewith a report, which summarizes our observations, and what we believe to be the areas of strength, program limitations, as well as our recommendations for improvement.

Program Overview:
The Academy of Mechanical Engineering is a unit of the College of Engineering at CETYS University. The program is offered at three residential campuses, Mexicali, Tijuana, and Ensenada, with slight differences in flavor and emphasis. The Mexicali campus houses the largest of the three with a current enrollment of 112 students. The curriculum of the Mechanical Engineering program is comprised of courses in mathematics, sciences, and

general education, as well as engineering science and design courses. Students can select one the two areas:

- Mechanical with an emphasis on either Automotive Design or Aerospace Design
- Mechatronics (which is combination of mechanical and electronic courses)

Mission and Vision

The program mission is:

> Assist in the training of professionals, leaders in solving problems of mechanical engineering, highly competent in the application and development of new technologies, with a global and international vision and the capacity to meet the challenges of the environment in which they unfold, in an ethical way and with a vocation oriented towards service to society

Comment: The statement is strong in emphasis on problem solving abilities, leadership, and global vision, ethical and moral responsibilities. However, the statement fails to assume sole and direct responsibility for the development of these abilities, skills and attitudes, by saying "Assist in.." We propose starting with "To educate and train professionals, leaders…."

Program Educational Objectives

- Graduates of these programs will be able to practice significantly in projects related to mechanical engineering
- The alumni from this program will be able to pursue graduate studies with success
- The alumni from this program will be able to find a professional job within 6 month
- The alumni from this program will be able to find a professional job within 6 months after graduation
- The graduates from this program will be able to start his/her own business
- The graduates of this program will be able to reach mid-level positions in 3 years and a managerial level within 5 years

Comments: Program educational objectives (PEO) are those attributes which graduates of are expected to have 3-5 years after graduations. Attaching metrics such as "find a professional job within 6 months." is not needed.

Curriculum

The curriculum of Mechanical Engineering consists of a total of forty-six (46) courses in mathematics, sciences, engineering sciences, engineering design, as well as courses in general education. In addition students must complete 400 hours of professional practice and 500 hours of social service.

Upon completion students should take the undergraduate exit exam EGEL administered by CENEVAL (organization in México that offers examination services). There are only few sections of this exam that are related to mechanical engineering training. In fact, there is no penalty if student does not pass this exam. Therefore, the usefulness of the exam is questionable unless it is required by Mexican Higher education system.

The general education course are designed to teach verbal and written communication and critical thinking skills and help foster the attitudes such as tolerance to diversity and life long learning

Comments: The curriculum in Mechanical engineering is well designed and is on par with traditional Mechanical Engineering programs in the United States. The requirements of 400 hours of professional practice and 500 hours of social service are particularly noteworthy and one of the strengths of the programs. We have no recommendation for improving the curriculum.

Learning Outcomes:

The learning outcomes of the program, knowledge, skills, and attitudes, acquired by students upon completion of the degree are in three categories:

1. Institutional learning outcomes
2. Engineering outcomes
3. Mechanical Engineering outcomes

Institutional outcomes are those related to general education and are focused on written and oral communication, critical thinking, life long learning and diversity.

The program outcomes, those which all engineers much achieve, including Mechanical Engineering outcomes, are described in the self-study report, SLO_ENG 1 – SLO-ENG 3 and SLO_IM 1 – SLO IM 4 are:

- SLO_ENG1: …solve problems relating to the improvement of diverse systems, correctly applying the knowledge and tools provided by the basic sciences and/or software technologies.
- SLO_ENG2: … effectively design and manage projects
- SLO_ENG3: … (Clear and effective communication in English) … be able to express his ideas clearly and with an appropriate language, in a verbal, written, and visual way in English.

- SLO_IM1: Apply the theoretical and practical fundamentals of the properties of engineering materials, for the optimal selection of materials given an application
- SLO_IM2: Evaluate various alternatives in the production of products analyzing the

aspects of ease of manufacture, resource optimization and evaluation of various modern manufacturing technologies

- SLO_IM3: Devise thermal systems for producing and consuming power, evaluating their thermal efficiency
- SLO_IM4: Devise, analyze and evaluate different elements of machines and mechanical systems for optimal performance

- *Comments: The program Learning Outcomes, Institutional, Engineering, Mechanical Engineering, broadly reflect the outcome achieved by a student completing the curriculum. Absence of mathematics in SLO_ENG 1 is conspicuous and should be added (…solve problems relating to the improvement of diverse systems, correctly applying the knowledge and tools provided by the basic sciences and/or software technologies.). We propose changing this to: (be able to apply the knowledge of mathematics, sciences, and computer aided engineering tools in solution of a variety of engineering problems.) We also propose preparing a "paper chart" showing where in the curriculum each of these outcomes could be achieved.*

Faculty:

The faculty participating in the program is 15. About 60% of the faculty is made of adjunct, many of them teaching a full load and have been with the institution for many years. With few exceptions the highest degree earned by the faculty is Masters.

Comments: The number of faculty to deliver the program is sufficient. The large percentage of adjunct faculty is a point of concern. Although most adjuncts teach a full load, full-time affiliation with the institution is highly desirable. During our visit it was pointed out that most adjunct faculty have industry ties or also work for industry. This we consider to be one of programs strengths. However, we recommend steps to be taken to bring them onboard as full-time. Another concern is the rarity of having a terminal degree among the faculty. We strongly recommend that opportunities be provided for current faculty members to earn their doctoral degrees.

Students:

The largest population of students in the field of mechanical engineering is on the Mexicali Campus (about 50%) followed by Tijuana Campus (40%) and Ensenada 10%.

Data shows that the total of 29 students was graduated during the academic year of 2009 with the following breakdown:

- Mechatronics total graduates were 15 (13 from Mexicali and 2 from Tijuana)
- Mechanical were 14 graduates (7 from Mexicali and 7 from Tijuana)

There has been a drop in number of students during 2009 academic year. This drop may reflect the general recession and harsh economic situation in Mexico and elsewhere.

Assessment Processes and Evaluations of Program Learning Outcomes

A good part of the self-study report and the presentation during our visit was devoted to assessment of learning outcomes.

Comments: There appears to be established processes in place for measuring the achievement of learning outcomes. Direct assessment method of using rubrics to assess the attainment of selected number of learning outcomes has been employed. What we were unable to determine is the continuous quality improvement as the result of the assessment, the so-called "closing the loop." We did not see evidence of surveys or other measuring tools showing the attainment of the program educational objectives and their appropriateness. Absent also was how program educational objectives were developed, and identification of program constituencies.

Program Improvement and Development

The CETYS has a high potential for growth. CETYS campuses in Tijuana and Mexicali are located in the heart of maquiladora companies. This means that CETYS could play a dominant role providing highly qualified professionals and engineers to fulfill the manpower needs in the region.

Summary and Additional Comments:

- As discussed please delete the statements of "The alumni from this … job within 6 months after graduation" and "The graduate of this program …in 3 years" (see slide 6).

- Measuring Institutional Learning Outcome has been started in 2008 and (slide 24-29) indicate tremendous effort. Though the results are impressive, however, there is room for further improvements.

    - With regards to SLO_ENG1 (… problem solving…), in general, 74% of engineering students obtained learning achievement levels of 2 or 3 (Reinforcement/Improvable, Evaluation/Outstanding): We suggest to improve further the result to be at least 80%) (see Slide 31)
    - With regards to SLO_ENG2 (… project management…), in general, 99.3% of engineering students obtained learning achievement levels of 2 or 3 (Reinforcement/Improvable, Evaluation/Outstanding): for level 2 which is 62% seems low and need improvement but level 3 performance is very good for level 3 (see slide 32)
    - The result of the assessment for SLO_IM1 Program (see slide 34) is unclear.

    - Learning Assessment - Improvement Actions Derived from the Outcomes is Unclear.

- The re-accreditation of 2012 by the Accreditation Board of Engineering Teaching CACEI (*in Spanish: "Consejo de Acreditacion de la Enseñanza de la Ingenieria"*) greatly facilitate the industry linkage and creates a momentum to attract new students.

- Faculty performance has many indicators including: number of publications in reputed journal or conference presentations in addition to their teaching load along with student satisfaction. In order to comply with the Engineering school goal, it is suggested to develop an environment of training and research at CETYS as opposed to the mainly teaching institution as known presently. It should be noted that CETYS Faculty teach on average 4 courses/quarter requiring 20 hours/week. It is anticipated that at least 20 hours is required for class preparation, homework assignments, and other course administrative task. Therefore, CETYS faculty member will not be able to undertake additional tasks such as research and new project development. It is suggested that the present policy be revised allowing faculty to carry on lower teaching load in lieu of more actively engage in the research area

- CETYS Mechanical Engineering since 2001 participation in the Collegiate Experience and International Competitions with resulting in continuous improvement is commendable and should be encouraged (see slides 42 and 43).

6. Conclusions and long-term goals (4 years) for the program

After reviewing the Mechanical Engineering Program, an analysis was made of the current situation of the program and the conclusions from every aspect. The Academy of Mechanical Engineering (AIM for its Spanish acronym) establishes the following proposals for improvement of the Program and groups it in three areas regarding:

1. Students
2. Professors
3. Curriculum

6.1 Goals and capacity challenges

Regarding Students:

Tendencies of New Enrollment and Re-enrollment:

- Population of the Mexicali Campus has gradually increased throughout the years.
- Population of the Tijuana Campus had shown a rising behavior until 2011. It suffered a down fall in 2012.
- Population in the Ensenada Campus shows stability with a slight downfall in the last cycle.
- Distribution of the total population of the program is approximately 50% in the Mexicali Campus, 40% in Tijuana Campus, and 10% in Ensenada Campus.

Retention and Efficiency:

- The Mexicali Campus showed a graduation rate above the goal of the engineering school for generations 2005 and 2006.
- In year 2007 the rate decreased in relation to the expectations, which is probably related to the fact that there was a change in the curriculum that includes a higher number of subjects due to the inclusion of specialties.
- With the exception of generation 2007, Mexicali shows a graduation rate higher or equal to the one shown by the engineering school.
- For generation 2009, the last to graduate, there was a significatn decrease of the rate for the school as well as the program.
- In the Tijuana Campus the first and second generations that graduated are below the expectations.

Learning and CENEVAL Results:

- Regarding the Learning Objectives of the Mechanical Engineering Program, the results obtained in 2013-1 are as expected, based in the curriculum of IM Learning Results.
- Results obtained for the RA-ING evaluated to this date are mostly in level SO.
- Performance levels obtained in CENEVAL have shown variations in the different generations.
- It is desirable that students obtain **at least DS**.
- In the generation that graduated in 2013, it can be seen that any student obtained outstanding performance (DSS), only 29% obtained satisfactory performance (DS) and 71% obtained NOT satisfactory performance (ANS).
- It is worrisome to the academy to see that the level of ANS in the last generation was of 71% and that no student achieved level DSS.

Regarding Professors:

Grade of Studies:

- Grade of studies of the professors that teach professional subjects in each campus is as follows:
- In Mexicali Campus there are 9 professors for the 28 subjects. Only one of them has a Bachelor's degree (11.11%), the rest have Master's degrees (88.89%).
- In Tijuana Campus there are 13 professors for the same 28 subjects, 6 of them with Bachelor's degrees (46.15%) and 7 with Master's degrees (53.85%).
- In Ensenada Campus there are 3 professors for the 6 professional subjects, 2 of them have Master's degrees (66.67%) and one has a PhD (33.33%).

Evaluation of the Teaching Learning Process:

- The evaluations presented were taken from the professor evaluation system.
- Even though only the results obtained in semester 2012-2 are shown, the general behavior indicates that the majority of the professors obtain evaluations higher than 8, which is the minimum expected.
- To improve performance of the professors that do not obtain an evaluation higher than 8, there are workshops and training sessions through professor education programs and professors are invited to attend.

Evaluation in: Service/Partnerships, Research and Publications

The areas where the academy has contributed are Service and Partnerships.

- In the service area, what is more commonly requested are training and update sessions. Some of them are offered by request of companies, others as part of CETYS plans and programs.
- In the partnerships area, there are several activities and projects that have been carried out to this date. In some projects, multidisciplinary teams are created to provide what the industry requests; others involve participation of more than one campus. All the projects are hired through CETYS partnerships department.

Regarding Curriculum:

National and International Accreditation:

- There is a plan currently in development to address the recommendations made by CACEI to the program.
- Additional to said plan, it is important to mention that the construction activities for the Center for Excellence in Design and Innovation are about to start. The school of engineering and additional laboratories will be located in this building.
- It is also important to mention that CONACYT-EMPRESA projects where students and professors will participate are being carried out.

Program Subjects:

- The distribution by areas of study has a strengthening toward the area of mechanical analysis and design.
- There is a deficit in the number of subjects in the areas of manufacture, materials and thermal.
- There is a deficit in laboratory hours for subjects that require them due to lack of equipment, laboratory space and human resources.

SUPPORTING RESOURCE	DERIVED CONCLUSIONS

Book Collection	According to the external evaluators from CACEI, the variety and quantity of copies in the collection are insufficient.
Facilities	The institutional development plan toward 2020 is being currently carried out. This plan aims to operate a multi-campus system with the necessary services and infrastructure to support the type of education expected to be achieved in 2020 Plan.
Equipment	Some of the laboratories and the equipment in them have been in use for an average of 20 years without being renewed, showing continuous failure. (Metallurgy Laboratory with more than 30 years in use, Thermal Laboratory equipment with more than 20 years, etc.)
Full-time Professors	Mexicali Campus: of the 9 professors teaching the 28 Professional Subjects, 1 is a full-time professor, 1 is a half-time professor and the rest of them are auxiliaries. Tijuana Campus: of the 13 professors teaching the 28 Professional Subjects, only 2 of them are full-time professors and the rest are auxiliaries. Ensenada Campus: of the 3 professors teaching the 6 Professional Subjects, only 1 of them is a full-time professor and the rest are auxiliaries.
EDEC in the program and the new aspects	All the Diferentiating Elements of CETYS Education (EDEC) are promoted in some way through activities, intermediate and final projects in the General Educatoin Subjects, Engineering Subjects and Professional Subjects. Other paralell activities to the program's subjects promoted by other departments in the campus, such as the Entrepreneurs Program and Academic Exchange, support promotion of the EDECs in the program. Some of the EDECs are promoted in a curricular manner

6.2 Goals and effectiveness challenges

Regarding Students:

New Enrollment and Re-Enrollment:

- To introduce remedial classes in the areas of Mathematics and Information Technology for all students who obtained less than 1,100 points in the admission test. ***AIM***

Institutional and Program Learning:

- Folow the Learning Results Assessment Plan established by the Academy. ***AIM***
- Analyze the results obtained by generation according to the Assessment Plan to implement the necessary improvements. ***AIM***
- Provide a workshop for all professors teaching subjects in the program,to make the Assessment Plan known. ***AIM***
- It is desirable that all professors teaching the same subject evaluate Mechanical Engineering students according to the Assessment Plan. ***AIM***
- Conduct longitudinal studies of each student. ***AIM***

CENEVAL Performance:

Suggestions regarding CENEVAL Performance are the following:

- Make an analysis of the subjects included in the program and their content. ***AIM***
- Students who obtain ANS performance cannot be candidates to academic recognition. ***AIM***
- Students who obtain DS or DSS performance obtain a bonus in at least one of the subjects they are taking. ***AIM***
- Introduce a CENEVAL-type test in the middle of the program. ***AIM***
- The four study areas of the program need to be reinforced. ***AIM***
- Revise the content and structure of the exercises in the CENEVAL test. ***AIM***
- Increase the number of subjects to broaden the spectrum of concentration in Mechanical Engineering. ***AIM***

Regarding Professors:

Number:

- Have five full-time professors (one per area): ***AIM***
- Promote teachers who currently work in the program. **CACEI, WASC, AIM**

Academic Credentials:

- It is strongly recommended to provide opportunities for teachers currently working in the program to obtain Doctoral Degrees. ***WASC, AIM***

Evaluation:

- Introduce studies of correlation between the students' evaluation and professors' evaluation of the students (absences, final grade, averages and standard deviation): ***AIM***

Service/Linking:

- Establish a development plan for all professors where they work in local companies to offer their services and at the same time get updated in the professional requirements of the industry (part-time), for example every 3 years. ***AIM***

*Research/Publications**:***

- Establish incentives and provide opportunities to professors to make publications: ***AIM***
- Support teachers with affiliation to magazines and research centers: ***AIM***

Regarding the Curriculum:

National and International Accreditation:

- Follow up the recommendations made by CACEI, WASC and AIM through a plan and assign a coordinator to be in charge of the process. ***AIM***
- Propose ABET accreditation ***AIM***

Operation of EDECs and other distinctive elements of the program:

- Establish agreements with universities that offer degrees in Mechanical Engineering. ***AIM***
- Offer online courses for subjects that do not require strong laboratory activities and/or analysis and encourage professors to design them. ***AIM***
- Open opportunities for students to do their professional practice in Research Centers. ***AIM***