WASC Accreditation
Educational Effectiveness Review

Bachelor's in Mechanical Engineering.
The program is currently offered in the following Campuses: Mexicali, Tijuana and Ensenada.

Last Program Review: November 2007

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1. **Introduction.**

The Mission of the Bachelor's in Mechanical Engineering Program is to generate highly qualified professionals in mechanical design with a perspective towards team work, and with the support of integrated modules of mechanical analysis and computer simulation, that allow for shorter time between conceptualization and prototype development, to manufacturing of products. These professionals will master the competencies required to formulate and solve problems of mechanical design, of products and of dedicated equipment for their manufacturing, and the solutions will consider impact on the environment, people and sustainable development.

The Vision of the Bachelor's in Mechanical Engineering Program is to maintain itself as the leader in the area of mechanical design in the region, focusing on the development of professionals in the metalmechanics industry with an emphasis on the required abilities in the four primary areas of Materials, Manufacturing, Thermal and Mechanical Design.

The Bachelor's in Mechanical Engineering Program was launched in the Mexicali Campus in 1979, in the Tijuana Campus in 2004, and in the Ensenada Campus in 1991. Since 1979, it has undergone 5 major reviews, in 1986, 1992, 2000, 2004, and 2007. The total number of alumni for the program, for the Mexicali Campus is around 190, for the Tijuana Campus there is not graduates yet, and for the Ensenada Campus all the student must finish in Mexicali or Tijuana.

Some significant achievements relating to the Bachelor's in Mechanical Engineering Program are:

- The program received the accreditation by CACEI in February of 2006.
- CETYS University is the first in the northwest to begin computer aided design in México 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.
- Graduates of the program have launched the computer design areas in Mexicali of companies such as Kenworth, Accurride, Jonathan, MRTC de Honeywell, US Elevators, etc.
- Graduates of the program have had success as entrepreneurs creating companies such as Metalium [Tijuana], PERSAL [Mexicali], METALCO[Mexicali], TERMEC[Mexicali], Mto de gruas[Mexicali], Tecnografika[Tijuana], to name a few.
- Graduates of the program have obtained Masters degrees in Massachusetts Institute of Technology, Leeds University, Warwick University, Birminghan University, ITESM, to name a few.
- Graduates of the program have obtained PhD degrees in Urbana Champaign-Illinois, Arizona State University, to name a few.
- Graduates of the program work abroad: Driessen train división en Vermont Canada, Driessen Design Center at Garden Grove CA, Engineering Manager of Boeing at Long Beach CA, Tool Design of Skyworks, International Elevators at Montreal, to name a few.

2. Denomination and description of the academic program.

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

a) Mechanical Design.
b) Thermal.
c) Materials.
d) Manufacturing.

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

a) Aerospace Design.
b) Automotive Design.

To obtain the degree, a student must complete the following requirements:

- Accreditation of 42 courses (totaling 328 credits) for the 2004 programs and 42 courses plus 4 additional Complementary Formation Line courses (totaling 360 credits) for the 2007 programs.
- Completing 400 hours of professional practice.
- Completing 500 hours of social service.
- Completing the corresponding EGEL examination administered by CENEVAL.
- Completing any of the degree obtainment requirements established by CETYS University.

The program has chairs by campus, who are full time faculty that are in charge of the program, and are involved in enrollment and promotional activities, student guidance and alumni follow up, program review, accreditation projects, etc. The program has chairs in the Mexicali Campus and Tijuana Campus, and none in the Ensenada Campus because only half of the program is offered there. The chairs are:

- M.S. Bernardo Valadez – Mexicali Campus.
- M.S. Gustavo Zambrano – 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.
- B.E. Dalia Holanda – Mexicali Campus.
- M.S. Gustavo Zambrano – Tijuana Campus.

The students of the program are full time, primarily male and local, and most of the students receive some sort of financial aid, the primary one being the Pro-Engineering scholarship. Students enrolled in the Ensenada Campus do the first four semesters in the Ensenada Campus and finish the last four semesters either in the Mexicali Campus or Tijuana Campus.

The program currently has the following laboratories by campus:

- Mexicali: Physics, Computer Design and Engineering, Materials and Metalurgy, Thermal and Fluids, Machine Shop, Manufacturing Processes.
- Tijuana: Physics, Manufacturing, Advanced computing, Mechatronics.
- Ensenada: Physics, Advanced Computing and Electronics, Mechatronics.

Student population - Mexicali			
Semesters	**Male**	**Female**	**Total**
1 and 2	16	3	19
3 and 4	9	0	9
5 and 6	5	1	6
7 and 8	26	6	32
Total	56	10	66
Percentage	84.8%	15.2%	100%

Student population - Tijuana			
Semesters	**Male**	**Female**	**Total**
1 and 2	10	0	10
3 and 4	0	0	0
5 and 6	0	0	0
7 and 8	0	0	0
Total	10	0	10
Percentage	100%	0%	100%

Student population - Ensenada			
Semesters	**Male**	**Female**	**Total**
1 and 2	5	0	5
3 and 4	4	0	4
5 and 6	0	0	0
7 and 8	0	0	0
Total	9	0	9
Percentage	100%	0%	100%

August – December 2007 (SIA-CETYS)

3. Educational Objectives of the academic program.

The Educational Objectives that the Academy of Mechanical Engineering have established for the Bachelor's in Mechanical Engineering are the following:

- The alumni from this program will be able to participle in important manner in projects related with Product Development.
- 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 months after graduation.
- The graduate from this program will be able to start his/her own business.
- The graduate from this program will be able to fill middle or top manager positions with in 3 years after graduation.

These Educational Objectives will be the primary focus for alumni studies and follow up, which will be used for various purposes during the assessment cycle, as well as program review.

4. Learning outcomes of the program and metrics for assessment.

There are 5 Learning Outcomes for all Engineering Bachelor's Programs that have been established by the Academies of the Engineering College, that describe knowledge, abilities and attitudes that every engineering student must achieve by the end of the academic program. These are:

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.

The Learning Outcomes that the Academy of Mechanical Engineering have established for the Bachelor's in Mechanical Engineering are grouped into 3 that correspond to the Professional Formation Lines and 1 for each of the 3 Complementary Formation Lines or Emphasis options of the program. These are:

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 student of the Bachelor's 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's 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 above student learning outcomes are a work in progress and are a part of the assessment cycle and program review, however we are just beginning to understand and develop tools to measure them.

#	Student Learning Outcomes	Metrics to evaluate student performance	Evidence of achieved learning
1	SLO_ENG1	Currently the system that is in place to evaluate student performance is a scale of 0 to 100, where a grade above 70 is considered as "passing" and below as "failing". Rubrics for the Engineer College are being developed to evaluate these learning outcomes. The rubrics are being developed by the Academy of Basic Sciences in conjunction with the other Academies of the Engineering College.	Student Work and Final Projects from selected courses (i.e. Physics II and III, Statistical Inference, Programming Methods II, Numerical Methods). EGEL Examination (Basic Sciences areas).
2	SLO_ENG2		
3	SLO_ENG3		
4	SLO_ENG4		
5	SLO_ENG5	This learning outcome is measured by the English Language Center (ELC) using appropriate performance standards for the study of ESL.	Student work follow up administrated by ELC.
6	SLO_IM1	Currently the system that is in place to evaluate student performance is a scale of 0 to 100, where a grade above 70 is considered as "passing" and below as "failing". Rubrics to evaluate these learning outcomes are being developed by the Academy of Mechanical Engineering.	Student Work and Final Projects. EGEL Examination (Professional areas).
7	SLO_IM2		
8	SLO_IM3		
9	SLO_IM4		
10	SLO_DAE	These outcomes have not yet been evaluated, and no evidence exists, however, the same type of rubrics developed for outcomes SLO_IM1, SLO_IM2, SLO_IM3 and SLO_IM4, will be applied, and these will be developed by the Academy of Mechanical Engineering.	No evidence exists.
11	SLO_DAM		

The Academy of Mechanical Engineering has the following members:

Name of the Academy or Faculty Coop: Academy of Mechanical Engineering.				
#	**Name**	**Degree**	**Area of knowledge**	**Campus**
1	Bernardo Valadez	Master's in Science	Mechanical Design	Mexicali
2	Maribel Lazcano	Master's in Science	Manufacturing	Mexicali
3	Alma Abad	Master's in Science	Materials	Mexicali
4	Dalia Holanda	Bachelor's in Engineering	Thermal	Mexicali
5	Gustavo Zambrano	Master's in Science	Manufacturing	Tijuana

5. Curriculum and faculty resources.

Bachelor's in Mechanical Engineering											
Semester	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Full time faculty**		
									Name	**Degree**	**Area**
Fundamentals for Bachelor's in Engineering	MA400	MA401	MA402	MA407					Alfredo Rodriguez David Sánchez Salvador Baltazar Susana Dominguez Jesús Sánchez Isaac Azuz	M.A. B.E. M.S. M.S. B.E. Dr.	Math, Stat Math, Phis Mah, Phis Math, Phis Math Math, Stat
	CC400	CC402	MA403	MA404	MA406						
		FI400	FI401	FI402							
		MC400									
Professional Formation in Mechanical Engineering	MC401	MF400	MF401	MC402	MC404	MC406	MC409	MC412	Bernardo Valadez Maribel Lazcano Alma Abad Dalia Holanda Gustavo Zambrano	M.S. M.S. M.S. B.E. M.S.	Mech.l Design Manufact. Materials Thermal Manufact.
				MF402	MC403	MC408	MC410	MC414			
					MC405	MC407	MC411	MC413			
							Elective I	Elective II			
Complementary Formation or Emphasis Options					Emphasis Elective I (DAE, DAM)	Emphasis Elective II DAE, DAM)	Emphasis Elective III (DAE, DAM)	Emphasis Elective IV (DAE, DAM)			
General and signature courses	CS401		CS400		ID400	CS402			Professors from Social Science Department.		
	EC400	CS403	CS404			HU4001	HU400	HU402			

Legend for courses:

CODE	COURSE
MA400	Mathematics for University
CC400	Programming Methods I
MC400	Computer Aided Drawing
MA401	Differential Calculus
CC402	Programming Methods II
FI400	Physics I
MA402	Integral Calculus
FI401	Physics II
MA403	Numerical Methods
MA404	Probability
MA407	Differential Equations
FI402	Physics III
MA406	Multivariable Calculus
MC401	Introduction to Mechanical Engineering
MF400	Materials Properties
MF401	Materials Manufacturing
MC402	Mechanics of Materials
MF402	Computer Aided Fabrication

CODE	COURSE
MC403	Fluid Mechanics
MC404	Introduction to Design
MC405	Physical Metalurgy
MC406	Finite Modelling
MC407	Electro-Pneumatic and Hydraulic Systems
MC408	Thermodynamics
MC409	Design Engineering
MC410	Dynamics of Mechanisms
MC411	Automation and Control
MC412	Mechanical Experimental Analysis
MC413	Plant Engineering
MC414	Heat Transfer
	Elective I
	Elective II
	Emphasis Elective I (DAE, DAM)
	Emphasis Elective II (DAE, DAM)
	Emphasis Elective III (DAE, DAM)
	Emphasis Elective IV (DAE, DAM)

6. Curricular mapping.

			ENGINEERING BACHELOR'S PROGRAMS STUDENT LEARNING OUTCOMES				BACHELOR'S IN MECHANICAL ENGINEERING STUDENT LEARNING OUTCOMES				EMPHASIS OPTIONS FOR MECHANICAL ENGINEERING STUDENT LEARNING	
CURRICULAR ELEMENTS			SLO_ENG1	SLO_ENG2	SLO_ENG3	SLO_ENG4	SLO_IM1	SLO_IM2	SLO_IM3	SLO_IM4	SLO_DAE	SLO_DAM
CODE	COURSE	SEMESTER	LEVEL	LEVEL	LEVEL	LEVEL	LEVEL	LEVEL		LEVEL	LEVEL	LEVEL
MA400	Mathematics for University	1	SU	SU								
CC400	Programming Methods I	1	SU	SU	SU							
MC400	Computer Aided Drawing	1	SU	SU	SU							
MA401	Differential Calculus	1	SU	SU								
CC402	Programming Methods II	2	ME	SU	SU	SU						
FI400	Physics I	2	SU	SU	SU							
MA402	Integral Calculus	2	ME	SU								
FI401	Physics II	3	ME	SU	SU							
MA403	Numerical Methods	3	ME	SU	ME							
MA404	Probability	3	ME	SU								
MA407	Differential Equations	4	ME	SU								
FI402	Physics III	4	ME	ME	SU	SU						
MA406	Multivariable Calculus	5	ME	SU								
MC401	Introduction to Mechanical Engineering	1	SU	SU	SU							
MF400	Materials Properties	2	SU	SU	SU	SU	ME	SU	SU	SU	SU	SU
MF401	Materials Manufacturing	3	ME	ME	SU	SU	SU	ME	ME	ME	SU	SU
MC402	Mechanics of Materials	4	ME	ME	ME	ME	SU	SU	SU	ME	ME	ME
MF402	Computer Aided Fabrication	4	ME	SO	SO	ME	SU	SO	ME	SO	ME	ME
MC403	Fluid Mechanics	5	ME	SU	SU	SU	SU	SU	SU	SU	SU	SU
MC404	Introduction to Design	5	ME	ME	SU	SU	SU	ME	ME	SO	ME	ME
MC405	Physical Metalurgy	5	SO	SO	ME	ME	SO	SO	SU	SO	ME	ME
MC406	Finite Modelling	6	SO	SO	ME	SU	SU	ME	SO	SO	ME	ME
MC407	Electro-Pneumatic and Hydraulic Systems	6	SU	ME	SU	SU	SU	SU	SU	SU	SU	SU
MC408	Thermodynamics	6	ME	SO	ME	SU	SU	SU	SO	ME	ME	ME
MC409	Design Engineering	7	SO	SO	ME	SU	ME	ME	SU	SO	SO	SO
MC410	Dynamics of Mechanisms	7	SO	ME	ME	SU	SU	SU	SU	ME	ME	ME
MC411	Automation and Control	7	SO	SO	SO	SO	SU	SU	SU	SU	SU	SU
MC412	Mechanical Experimental Analysis	8	SO	SO	SO	ME	ME	ME	SU	SO	SO	SO
MC413	Plant Engineering	8	SU	SU	SU	SU				SU		
MC414	Heat Transfer	8	ME	SO	SO	ME	SU	SU	SO	SU	ME	ME
	Elective I	7	SU, ME, SO	SU, ME, SO	SU, ME, SO	SU, ME, SO	SU, ME, SO	SU, ME, SO		SU, ME, SO	SU	SU
	Elective II	8	SU, ME, SO	SU, ME, SO	SU, ME, SO	SU, ME, SO	SU, ME, SO	SU, ME, SO		SU, ME, SO	SU	SU
	Emphasis Elective I (MSC, RIA, BIO)	5	SU, ME, SO	SU, ME, SO	SU, ME, SO	SU, ME, SO	ME	ME		ME	ME	ME
	Emphasis Elective II (MSC, RIA, BIO)	6	SU, ME, SO	SU, ME, SO	SU, ME, SO	SU, ME, SO	ME	ME		ME	ME	ME
	Emphasis Elective III (MSC, RIA, BIO)	7	SU, ME, SO	SU, ME, SO	SU, ME, SO	SU, ME, SO	SO	SO		SO	SO	SO
	Emphasis Elective IV (MSC, RIA, BIO)	8	SU, ME, SO	SU, ME, SO	SU, ME, SO	SU, ME, SO	SO	SO		SO	SO	SO
CO-CORRICULAR ELEMENTS		SEMESTERS	LEVEL	LEVEL	LEVEL	LEVEL	LEVEL	LEVEL		LEVEL	LEVEL	LEVEL
CETYS University College of Engineering Projects Expos in each Campus		2,4,6,8	SU, ME, SO	SU, ME, SO	SU, ME, SO	SU, ME, SO	SU, ME, SO	SU, ME, SO		SU, ME, SO	SU, ME, SO	SU, ME, SO
CETYS University College of Enginerering Simposiums in each Campus		1,3,5,7	SU	SU	SU	SU, ME, SO	SU	SU		SU	SU	SU
Scholarships awarded by external institutions		1,2,3,4,5,6,7,8	SU	SU	SU	SU, ME, SO	SU, ME, SO	SU, ME, SO		SU, ME, SO	SU, ME, SO	SU, ME, SO
External engineering competitions		1,2,3,4,5,6,7,8	SU, ME, SO	SU, ME, SO	SU, ME, SO	SU, ME, SO	SU, ME, SO	SU, ME, SO		SU, ME, SO	SU, ME, SO	SU, ME, SO
Professional Practice		6,7,8	SU, ME, SO	SU, ME, SO	SU, ME, SO	SU, ME, SO	ME, SO	ME, SO		ME, SO	ME, SO	ME, SO
Social Sevice		6,7,8	SU, ME, SO	SU, ME, SO	SU, ME, SO	SU, ME, SO	ME, SO	ME, SO		ME, SO	ME, SO	ME, SO
Student Exchange		6,7,8	SU, ME, SO	SU, ME, SO	SU, ME, SO	SU, ME, SO	ME, SO	ME, SO		ME, SO	ME, SO	ME, SO
CENEVAL EGEL Examination		8	SU, ME, SO	SU, ME, SO	SU, ME, SO	SU, ME, SO	ME, SO	ME, SO		ME, SO	ME, SO	ME, SO

Legend for levels used for curricular mapping:

SU ("*SUFICIENTE*") = SUFFICIENT.
ME ("*MEJORABLE*") = IMPROVABLE.
SO ("*SOBRASALIENTE*") = OUTSTANDING.

Legend for Student Learning Outcomes:

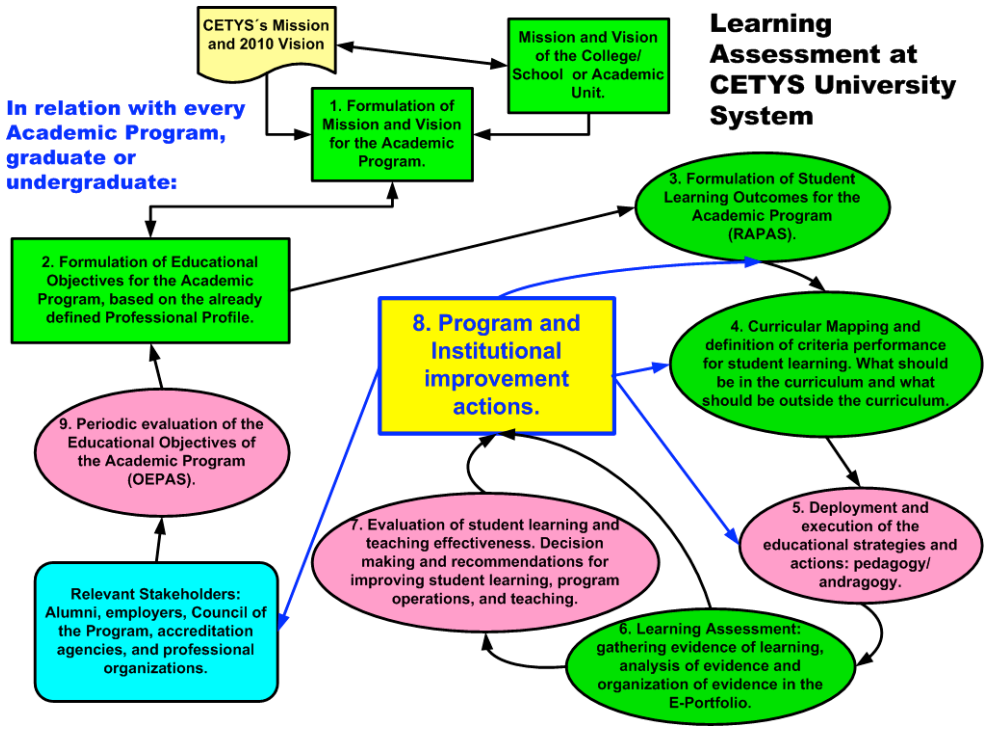
Engineering Bachelor's Programs. The student of a CETYS University Bachelor's in Engineering Program will…	**Bachelor's in Mechanical Engineering** The student of the Bachelor's in Mechanical Engineering program will…	**Emphasis Options for Bachelor's in Mechanical Engineering**
SLO_ENG1: …correctly 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_IM1**: … apply the theoretical and practical fundamentals of material properties in engineering, to make the optimal selection of materials for a given application.	The student of the Bachelor's in Mechanical Engineering with an Emphasis in Aerospace Design will… **SLO_DAE**: … 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.
SLO_ENG2: …design analytic and functional models, quantitatively and qualitatively, for the analysis and improvement of systems for diverse applications.	**SLO_IM2**: … evaluate diverse fabrication alternatives for products, analyzing aspects regarding ease of manufacturing, resource optimization and evaluation of modern manufacturing technologies.	The student of the Bachelor's 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.
SLO_ENG3: … effectively use software tools and technologies to build solutions to engineering problems.	**SLO_IM3**: … design and evaluate thermal systems to produce and consume power, and be able to evaluate the thermal efficiency of these systems.	
SLO_ENG4: … effectively design and manage projects.	**SLO_IM4**: … design, analyze and evaluate diverse machine elements and mechanical systems to obtain their optimal performance.	

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.

This learning outcome is developed primarily via the co-curricular ESL program that all students must go through, and which is managed by the English Language Center. Some curricular courses contribute to the improvement of this learning outcome, like Advance Communication in English and selected courses from 5th semester onward.

7. Assessment plan.

Based on the Assessment Plan for CETYS University System:



Currently, the following actions have been done, with regards to the Bachelor's in Mechanical Engineering Program, with the participation of faculty members from the Academy of Mechanical Engineering:

1) Formulation of the Mission and Vision.
2) Formulation of the Educational Objectives.
3) Formulation of Student Learning Outcomes.
4) Curricular Mapping.

The assessment components that are currently in the process of being defined, but have not yet been developed and therefore have not been implemented are:

a) Definition of assessment tools for student learning to be used in the assessment of the Student Learning Outcomes.
b) Identification of key courses where evidence of student learning can be gathered.
c) Systematic gathering of evidence of learning and the analysis and organization of the evidence.