WASC Accreditation
Educational Effectiveness Review

Master's of Science in 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 Master's of Science in Engineering Program is to generate high level specialists in select areas of engineering, who design and develop applied research projects for the improvement and innovation of local, regional and national organizations.

The Vision of the Master's of Science in Engineering Program is to be the primary source in the region for high level professionals who are specialists in select areas of engineering and have the knowledge and abilities to improve and innovate organizations.

The CETYS University Master's of Science in Engineering was created in 1992. The programs that were developed in that time were three and focused in the areas of: Industrial Management, Networks & Computing, and Manufacturing Systems.

The first formal review of the programs was done in 1997 and basically consisted in updating the content of the three programs, and also the creation of a new program focused on Optimization of Industrial Systems.

The last review was done in 2004, in which a need for integration of all the programs was identified. The programs were integrated into one core program with common courses and various emphasis areas that the graduate student could choose from according to his or her interest.

Three areas of knowledge were identified in which CETYS University has demonstrated to have the capacity to develop graduate programs, and it was around these three areas of knowledge that the emphasis areas were defined. The three areas of knowledge that were identified are: Industrial Engineering, Mechanical Engineering and Computing & Electronics.

Some significant achievements relating to the Master's of Science in Engineering Program are:

- **(ANOTAR AQUÍ UN LISTADO DE LOGROS)**

2. Denomination and description of the academic program.

The Master's of Science in Engineering Program is focused on three Primary Professional Formation Lines: COMMON, EMPHASIS and APPLIED RESEARCH:

a) COMMON: Statistics, Project Management, Strategic Vision, Use of Technology.

b) EMPHASIS: Focused on three areas of knowledge defined by the college of engineering:

- INDUSTRIAL ENGINEERING: Industrial Management, Materials and Logistics Management, Quality and Productivity.

- MECHANICAL ENGINEERING: Manufacturing Design and Processes, Aerospace Engineering.

- COMPUTING & ELECTRONICS: Distributed Computing, Networks & Telecommunications, Control & Automation, Microelectronics & Semiconductors.

c) APPLIED RESEARCH: Applied Research Project.

The Master's of Science in Engineering Program is focused on the application of science, more than on research and advancement of science, and it is for this reason that, to obtain their degree, graduate students must accredit the 14 courses that comprise the program, and also develop an application project related to their area of emphasis, in which they must generate a report of the final results.

The program is offered with a mix of professors that are associates of the institution, professors from other national and international institutions, and professionals with master's degrees that are currently working in local and regional industry.

The program has no full time professors, it rather operates with the full time faculty of the college of engineering, that for the graduate college are considered associates, and it is this group of professors that support the development and evolution of the program.

The program has a statewide coordinator that is in charge of the quality of the program via the selection of the professors and close communication with them for course follow up. The program coordinator also has close communication with students via personal interviews and e-mail. The program coordinator is supported by the associate professors of the institution for student academic follow up in each of the campuses.

The program currently has 196 students in its Mexicali campus, 85 in its Tijuana campus and 18 in its Ensenada campus. The program has near to 200 graduates as of the fall 2007 period.

The list of supporting faculty members by emphasis area can be consulted in section 5.

3. Educational Objectives of the academic program.

The Educational Objectives that the Graduate College Academy has established for the Master's of Science in Engineering are the following:

- The alumni of this program will be a project leader for projects involving the areas of knowledge and emphasis that he or she chooses for applications in local, regional and national organizations.
- The alumni from this program will be able to do consulting projects involving the areas of knowledge and emphasis that he or she chooses for local, regional and national organizations.
- The alumni from this program will be able to continue their graduate studies to obtain higher degrees with success.
- The alumni from this program will be able to obtain higher level job positions in their current organization or in a new one within 6 months of the obtainment of the degree.

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 2 Learning Outcomes for all Master's Programs that have been established by the Graduate College Academy, that describe knowledge, abilities and attitudes that every graduate student must achieve by the end of the academic program. These are:

The student of a CETYS University Master's Program will…

- MPLO1: … develop applied research projects using the correct quantitative and qualitative methodologies, as well as information technologies, primarily data bases and information systems, for the solution of problems related to his or her area of specialization.
- MPLO2: … develop personal and professional competencies with a focus on specialization, for direct application in his or her work.

There is 1 Learning Outcome for the Master's of Science in Engineering Program that has been established by the College of Engineering and Graduate College Academy, that describes knowledge, abilities and attitudes that every graduate student from a Master's of Science in Engineering Program must achieve by the end of the academic program. The Learning Outcome is:

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

- MCIPLO: … solve problems related to the improvement and innovation of products and processes in organizations, applying knowledge and abilities in the areas of Statistics, Project Management, Strategic Vision and Information Technologies.

The Learning Outcomes that the College of Engineering and the Graduate College Academy have established for each of the Master's of Science in Engineering Emphasis Areas describe knowledge, abilities and attitudes that every graduate student from a Master's of Science in Engineering Program with a specific Emphasis Area must achieve by the end of the academic program. These are:

INDUSTRIAL ENGINEERING.

The student of a CETYS University Master's of Science in Engineering Program with an Emphasis in Industrial Management will…

- EAILO1: … analyze and solve problems in the context of industrial plant management, with an executive vision focused on decision making using modern manufacturing systems methodologies, and integrating tools relating to operations management, human resources, marketing and finance.

The student of a CETYS University Master's of Science in Engineering Program with an Emphasis in Materials and Logistics Management will…

- EAMLLO1: … analyze and solve problems in the context of supply chain management , with a focus on production systems with an operative and processes vision using methods and tools of inventory management, planning and forecasting, master planning, floor production control and lean manufacturing.

The student of a CETYS University Master's of Science in Engineering Program with an Emphasis in Quality and Productivity will…

- ECPLO1: … analyze and solve problems in the context of work systems' improvement, that are immersed in production processes using quality management and productivity tools applying a quantitative and optimization approach

MECHANICAL ENGINEERING:

The student of a CETYS University Master's of Science in Engineering Program with an Emphasis in Manufacturing Design and Processes will…

- EDPMLO1: … analyze and solve manufacturing design and processes problems with a focus on materials analysis, and product engineering using mathematical computer modeling for design, and modern manufacturing techniques.

The student of a CETYS University Master's of Science in Engineering Program with an Emphasis in Aerospace Engineering will…

- EIALO1: … analyze and solve problems in the context of aerospace and aeronautics engineering in two areas: (1) materials & structures, and (2) energy and propulsion, using mathematical models, shuttle conceptual design, materials for design and manufacturing and turbine theory.

COMPUTING & ELECTRONICS:

The student of a CETYS University Master's of Science in Engineering Program with an Emphasis in Distributed Computing will…

- ESCDLO1: … analyze and solve problems in the context of distributed computing with a focus on software development, using software architecture, advanced object programming, networks & operating systems, distributed system design and mobile computing.

The student of a CETYS University Master's of Science in Engineering Program with an Emphasis in Networks & Telecommunications will…

- ERTLO1: … analyze and solve problems in the context of networks & telecommunications with a focus on computer based communication systems, using specialized connectivity equipment, internet protocols, high performance network standards and equipment, cryptography techniques and data coding.

The student of a CETYS University Master's of Science in Engineering Program with an Emphasis in Control & Automation will…

- EACLO1: … analyze and solve problems in the context of industrial automation systems, using automatic control theory, programmable controllers technology, intelligent control systems and robotics.

The student of a CETYS University Master's of Science in Engineering Program with an Emphasis in Microelectronics & Semiconductors will…

- EMSLO1: … analyze and solve problems in the context of microelectronics and semiconductors, with a focus on integrated circuit processing, using solid state physics theory, integrated circuit fabrication techniques, materials properties and integrated circuit design.

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	MPLO1	Currently the system that is in place to evaluate student performance is a scale of 0 to 10, where a grade above 8 is considered as "passing" and below as "failing". Rubrics for the Master's Programs are being developed to evaluate these learning outcomes. The rubrics are being developed by the Graduate College Academy..	Student Work and Final Projects from selected courses, as well as the Applied Research Project
2	MPLO2		
3	MCIPLO		
4	EAILO1 EAMLLO1 ECPLO1 EDPMLO1 EIALO1 ESCDLO1 ERTLO1 EACLO1 EMSLO1		

The Graduate College Academy has the following members:

Name of the Academy or Faculty Coop: Graduate College Academy				
#	Name	Degree	Area of knowledge	Campus
1	Isaac Azuz	Doctor	Life Sciences	Ensenada
2	Alberto Gárate	Doctor	Education	Mexicali
3	Héctor Maymi	Doctor	Social Sciences	Mexicali
4	Rosa María Lamadrid	Master	Education	Mexicali
5	Miguel Salinas	Master	Computer Sciences	Mexicali
6	Mario Dipp	Master	Economics and Finances	Mexicali
7	José Gpe. Hernandez	Doctor	sicologia	Tijuana
8	Teresa Mercado	Master	Administration	Tijuana
9	Moises Sánchez	Doctor	Electrónica	Tijuana

The Graduate College Academy was created with the purpose of maintaining homogeneity between the different master's programs and their operation. The Academy defines, supervises and reviews admission criteria, academic conflicts, degree obtainment, etc. Each program in particular has a group of professors affiliated to the institution that supervise the development and evolution of the academic program.

The list of supporting faculty members by emphasis area can be consulted in section 5.

5. Curriculum and faculty resources.

The Master's of Science in Engineering program operates under the following structure. Students must complete 84 credits, equivalent to 14 courses. Students must comply with the adequate number of courses in each of the segments (Core, Emphasis, Electives, Applied Research). There is no specific time schedule under which they must complete their credits. Students have flexibility regarding which courses to take from each segment, and also when to take them. Academic coordinators provide guidance regarding what courses a student should take, considering their specific needs and objectives.

The Faculty resources are presented by emphasis area in the following table:

Master's of Science in Engineering Program Coordinator: M.S. Miguel Salinas		
First Year (6 courses)	Professors affiliated with the institution	Professors from other institutions and industry
COMMON, emphasis in: Statistics Project Management Strategic Vision Use of Technology Electives	Dr. Isaac Azuz M.A. Alfredo Rodríguez M.S. Miguel Salinas M.A. Fracisco Velez M.S. Salvador Chiu M.S. Enrique Fitch	M.A. Jesús Torres M.S. Marcos Quiroz
Second year (8 courses)	Professors affiliated with the institution	Professors from other institutions and industry
INDUSTRIAL ENGINEERING (7 courses), emphasis in: Industrial Management Materials and Logistics Management Quality and Productivity Academic Coordinator: M.S. Mauro Chávez	M.S. Cesar Barraza M.S. Carlos González M.S. Héctor Vargas M.I. Jaime Alvarez M.A. Carmina Contreras M.A. Mónica Acosta M.A. Mauro Chávez	M.S. Jesús Torres Acevedo Dr. Sergio Ruíz M.A. Marco Macedo M.A. Mariela Quiroga M.S. Marco Jiménez M.E. Eduardo Santiago M.S. Cesar Torres
MECHANICAL ENGINEERING (7 courses), emphasis in: Diseño y Procesos de Manufactura Ingeniería Aeroespacial Academic Coordinator: M.S. Bernardo Valadez	Professors affiliated with the institution	Professors from other institutions and industry
	M.S. Bernardo Valadez M.S. Alma Abad	Dr. Alexandro Castellanos Dr. Enrique Rodarte M.S. Orman Millan Professors COMEA Negotiating alliances with ASU,NAU and ERU.
COMPUTING & ELECTRONICS (7 courses), emphasis in: Cómputo Distribuido Redes y Telecomunicaciones Automatización y Control Microelectrónica y Semiconductores Academic Coordinator: M.S. Jorge Sosa	Professors affiliated with the institution	Professors from other institutions and industry
	M.S. Jorge Sosa M.S. Cristobal Capíz M.S. Guillermo Cheang M.S. Dania Licea M.S. Leopoldo Uribe Dr. Moises Sánchez Dr. Carlos Fuentes M.S. Héctor Barajas M.S. Marco Peña M.S. Daniel Moctezuma M.S. Carlos García M.S. Adolfo Esquivel	Dr. Arnoldo Díaz Dr. Alexandro Castellanos Alliance con USF Dr. Willie Moreno Dr. Andrew Hoff Dr. Jesús Finol Dr. David Snider
APPLIED RESEARCH (1 course) Application Project	Professors affiliated with the institution	Professors from other institutions and industry
	Dr. Isaac Azuz Dr. Héctor Maymi Dr. Moisés Sánchez	Dr. Arnoldo Díaz

6. Curricular mapping.

Legend for levels used for curricular mapping: **SU** ("*SUFICIENTE*") = SUFFICIENT.
ME ("*MEJORABLE*") = IMPROVABLE.
SO ("*SOBRASALIENTE*") = OUTSTANDING.

Curricular mapping																	
Course information and co-curricular efforts		**Institutional Learning outcomes**				**Academic Program Learning Outcomes**			**IND. MANAG.**	**MAT. AND LOG. MANAG.**	**QUALITY AND PROD.**	**MANUF. DES. AND PROC.**	**NETW. AND TELEC.**	**CONTROL AND AUTOM.**	**DIST. COMP.**	**MICRO. AND SEMIC.**	**AEROSP. ENG.**
CODE	**COURSE**	**IL O1**	**IL O2**	**IL O3**	**IL O4**	**MPL O1**	**MPL O2**	**MCIPL O1**	**OAI LO1**	**EAM LLO 1**	**ECP LO1**	**EDPML O1**	**ERTL O1**	**EAC LO1**	**ESC DLO 1**	**EMS LO 1**	**EIA LO1**
COMMON																	
MA502	Statistical Models	ME	ME			ME	ME	ME									
AD509	Project Management	ME	ME			ME	ME	ME									
AD510	Strategy and competitiveness	ME	ME			ME	ME	ME									
SI507	Decision Support Systems	ME	ME			ME	ME	ME									
APPLIED RESEARCH																	
CS501	Application Project	SO	SO			SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
INDUSTRIAL MANAGEMENT EMPHASIS																	
MF501	Manufacturing Strategies	SO	SO				SO		ME								
MF502	Diseño de Sistemas de Manufactura	SO	SO				SO		ME								
II508	Plant Operations Management	SO	SO				ME		ME								
II509	International Logistics Operations	SO	SO				ME		ME								
FZ509	Economic Evaluation of Industrial Projects	SO	SO				ME		ME								
RI516	Seminary of Human Resources	SO	SO				ME		ME								
MK511	Seminary of Marketing	SO	SO				ME		ME								
MATERIALS AND LOGISTICS MANAGEMENT EMPHASIS																	
II502	Supply Chain Management	SO	SO				ME			ME							
II503	Inventory Management	SO	SO				ME			ME							
II504	Forecast Models	SO	SO				ME			ME							
II505	Floor Production Control	SO	SO				SO			ME							
II509	Lean Manufacturing	SO	SO				ME			ME							
II506	Logistics and distribution	SO	SO				SO			ME							
II507	Simulation Systems	SO	SO				ME			ME							

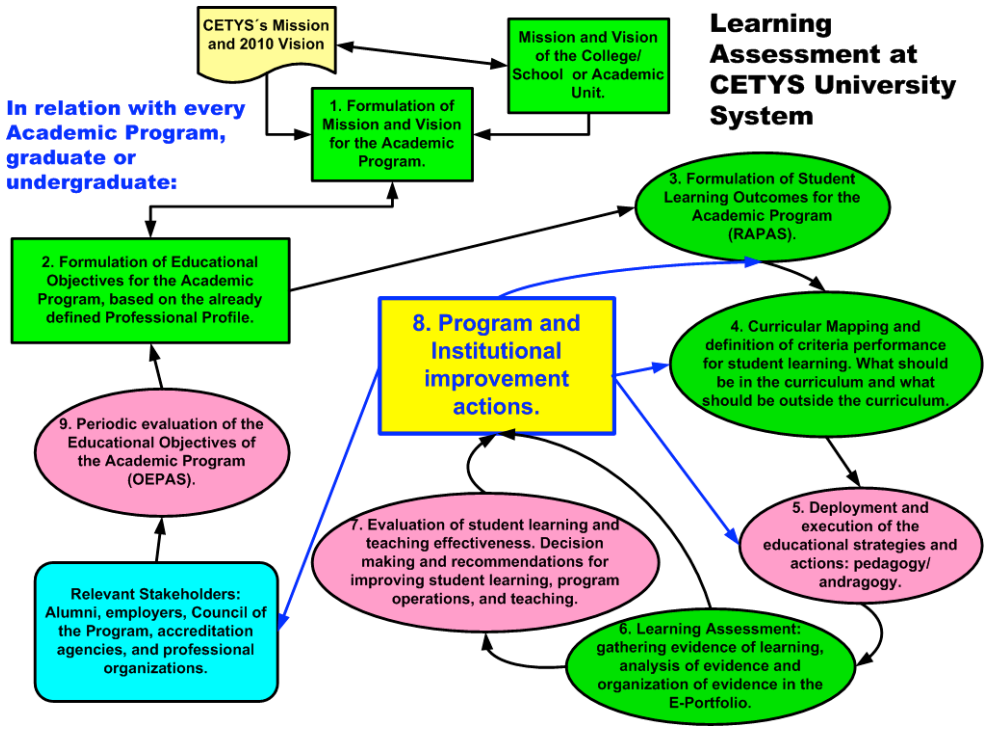
QUALITY AND PRODUCTIVITY EMPHASIS											
II510	Total Quality Management	SO	SO				ME			ME	
II511	Quality Norms and Systems	SO	SO				SO			ME	
II512	Quality Engineering	SO	SO				ME			ME	
II513	Statistical Methods for Quality Improvement	SO	SO				SO			ME	
II514	Production Systems	SO	SO				ME			ME	
II515	Applications of Optimization Models I	SO	SO				ME			ME	
II516	Applications of Optimization Models II	SO	SO				ME			ME	
MANUFACTURING DESIGN AND PROCESSES EMPHASIS											
MA503	Mathematical Models for Mechanical Systems	SO	SO				ME			ME	
MF503	Experimental Analysis for Mechanical Parts	SO	SO				ME			ME	
MF504	Energetic Design Tools for CAD-CAE	SO	SO				ME			ME	
MF505	Prototype Products Generation	SO	SO				SO			ME	
MF506	Materials Engineering	SO	SO				ME			ME	
MF507	Fundamentals of Thermofluids	SO	SO				ME			ME	
MF508	Design and Applications of Thermal Systems	SO	SO				SO			ME	
NETWORKS AND TELECOMMUNICATIONS EMPHASIS											
CE500	Telecommunications Fundamentals	SO	SO				ME			ME	
CE501	Connectivity and Networks Design	SO	SO				ME			ME	
CE502	High Perfomance Networks	SO	SO				ME			ME	
CE503	Wireless Networks	SO	SO				ME			ME	
CE504	Networks Security	SO	SO				SO			ME	
CE505	Information Coding Theory	SO	SO				ME			ME	
CE506	Integration of Networks Services	SO	SO				SO			ME	
CONTROL AND AUTOMATION EMPHASIS											
CE507	Fundaments of Control Systems	SO	SO				ME			ME	
CE508	Programmable Controllers Lab.	SO	SO				ME			ME	
CE509	Instrumentation and Control Systems	SO	SO				ME			ME	
CE510	Digital Control Lab.	SO	SO				SO			ME	
CE511	Automation and Control for Manufacturing	SO	SO				SO			ME	
CC507	Object	SO	SO				ME			ME	

	Programming and Control											
CC508	Intelligent Control Systems	SO	SO				ME			ME		
DISTRIBUTED COMPUTING EMPHASIS												
CC500	Architecture and Software Development	SO	SO				ME				ME	
CC501	Network and Distributed Systems	SO	SO				ME				ME	
CC502	Advanced Object Programming	SO	SO				ME				ME	
CC503	Object and Data Systems	SO	SO				ME				ME	
CC504	Distributed Systems Design	SO	SO				SO				ME	
CC505	Heterogeneous Systems Integration	SO	SO				SO				ME	
CC506	Mobile Computing	SO	SO				ME				ME	
MICROELECTRONICS AND SEMICONDUCTORS EMPHASIS												
CE512	Solid State Physics	SO	SO				ME					ME
CE513	Semiconductor Processing I	SO	SO				ME					ME
CE514	Semicinductor Processing II	SO	SO				SO					ME
CE515	Metrology and Characterizatio n of Semiconductor s	SO	SO				ME					ME
CE516	Digital and Analog VLSI Design	SO	SO				SO					ME
ELECTIVES:												
CE517	Structure and Property of Materials	SO	SO				SO					ME
CE518	Synthesis of Rapid Prototyoing	SO	SO				SO					ME
CE519	Principles of Electronic Microscopy	SO	SO				SO					ME
CE520	Design and Fabrication of MEMS	SO	SO				SO					ME
CE521	Introduction to Nanotechnolog y	SO	SO				SO					ME
AEROSPACE ENGINEERING EMPHASIS												
MA504	Avanced Mathematics	SO	SO				ME					ME
MF506	Materials Engineering	SO	SO				ME					ME
MF511	Conceptual Aircraft Design	SO	SO				ME					ME
MF512	Finite Element for Aeroespace Applications	SO	SO				ME					ME
MF513	Aerospace Prototype Generation	SO	SO				SO					ME
ELECTIVES:												
MF514	Aerospace Structural Analysis	SO	SO				SO					ME
MF515	Materials Endurance	SO	SO				SO					ME
MF516	Mechanics of Composite Materials	SO	SO				SO					ME
MF517	Aerodynamics	SO	SO				SO					ME
MF507	Fundamentals of Themofluids	SO	SO				ME					ME

MF519	Advanced Thermodinamics	SO	SO				SO			ME

7. Assessment plan.

Based on the Assessment Plan for CETYS University System:



Currently, the following actions have been done, with regards to the Master's of Science in Engineering Program, with the participation of faculty members from the Graduate College Academy and the College of Engineering:

1) Formulation of the Mission and Vision.
2) Formulation of the Educational Objectives.
3) Formulation of Student Learning Outcomes.
4) Curricular Mapping.
5) Identification of key courses where evidence of student learning can be gathered.

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) Systematic gathering of evidence of learning and the analysis and organization of the evidence.