
# College of Engineering

# Assessment Plan
# Program Level Learning Outcomes
## August-December 2010 – January-June 2011

# 1. Learning Outcomes.

The Student Learning Outcomes for an academic program are comprised by 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.

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.

The 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). Each Academy analyzed the original program level learning outcomes and re-defined them if necessary. This re-definition also allows for a more clear identification of the learning outcomes expected for the academic program, and updates them, taking into account assessment considerations. The analysis and re-definition of these Program Level Learning Outcomes may be found in the corresponding Program Review documents for each program.

## 2. Curricular Mapping.

The curricular mapping for the program level learning outcomes, in their redefined versions according to section 1 of this document, considers the following levels:

- INTRODUCTORY (I): *"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. Knowledhe and abbilities acquired from previous corses may be used to develop students in the solution of problems of low to mid 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.

- REINFORCEMENT (R): "At the end of the course the students are able to analyze and apply course topics in various contexts, which present diverse levls of dificulty". Knowledge, skills and abilities acquired from previous courses are used to develop solutions to application problems, of mid 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.

- EVALUATION - (E): *"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 congruent with the above levels, using different nomenclature (Sufficient, Improvable, Outstanding). This scale is also congruent with the program level scale of Introductory, in Development and Developed used by some of the Academies.

The three program level learning outcomes that apply to all engineering programs are mapped throughout the courses for each program, according to the following tables:

| INDUSTRIAL ENGINEERING | | | LEARNING OUTCOMES FOR ALL ENGINEERING PROGRAMS | | |
|---|---|---|---|---|---|
| CURRICULAR ELEMENTS | | | SLO_ENG1 | SLO_ENG2 | SLO_ENG3 |
| CODE | COURSE | SEMESTER | LEVEL | LEVEL | LEVEL |
| MA400 | Mathematics for University | 1 | I | I | I |
| CC400 | Programming Methods I | 1 | I | I | I |
| MC400 | Computer Aided Drawing | 1 | I | I | I |
| MA401 | Differential Calculus | 1 | I | I | I |
| CC402 | Programming Methods II | 2 | I | I | I |
| FI400 | Physics I | 2 | I | I | I |
| MA402 | Integral Calculus | 2 | I | I | I |
| FI401 | Physics II | 3 | I | I | I |
| MA403 | Numerical Methods | 3 | I | I | I |
| MA404 | Probability | 3 | I | I | I |
| MA407 | Differential Equations | 4 | R | R | I |
| FI402 | Physics III | 4 | R | R | I |
| MA405 | Statistical Inference | 5 | R | R | I |
| MA406 | Multivariable Calculus | 5 | R | R | I |
| II400 | Introduction to Industrial Engineering | 1 | I | I | I |
| MF400 | Materials Properties | 2 | I | I | I |
| MF401 | Materials Manufacturing | 3 | I | I | I |
| II401 | Industrial Chemistry | 4 | R | R | I |
| II402 | Industrial Management | 4 | R | R | I |
| II403 | Industrial Electronics | 5 | R | R | R |
| II404 | Methods Enginnering | 5 | R | R | R |
| II405 | Production Systems Engineering I | 6 | R | R | R |
| II406 | Quality Engineering | 6 | R | R | R |
| II407 | Operations Research Models I | 6 | R | R | R |
| II408 | Production Systems Engineering II | 7 | E | E | E |
| II409 | Design of Experiments | 7 | E | E | E |
| II410 | Operations Research Models II | 7 | E | E | E |
| II411 | Production Systems Engineering III | 8 | E | E | E |
| II412 | Economics Engineering | 8 | E | E | E |
| II413 | Simulation Systems | 8 | E | E | E |
| | Elective I | 7 | E | E | E |
| | Elective II | 8 | E | E | E |
| | Emphasis Elective I (LOP, AEM) | 5 | R | R | R |
| | Emphasis Elective II (LOP, AEM) | 6 | R | R | R |
| | Emphasis Elective III (LOP, AEM) | 7 | E | E | E |
| | Emphasis Elective IV (LOP, AEM) | 8 | E | E | E |

| MECHANICAL ENGINEERING | | | LEARNING OUTCOMES FOR ALL ENGINEERING PROGRAMS | | |
|---|---|---|---|---|---|
| CURRICULAR ELEMENTS | | | SLO_ENG1 | SLO_ENG2 | SLO_ENG3 |
| CODE | COURSE | SEMESTER | LEVEL | LEVEL | LEVEL |
| MA400 | Mathematics for University | 1 | I | I | I |
| CC400 | Programming Methods I | 1 | I | I | I |
| MC400 | Computer Aided Drawing | 1 | I | I | I |
| MA401 | Differential Calculus | 1 | I | I | I |
| CC402 | Programming Methods II | 2 | I | I | I |
| FI400 | Physics I | 2 | I | I | I |
| MA402 | Integral Calculus | 2 | I | I | I |
| FI401 | Physics II | 3 | I | I | I |
| MA403 | Numerical Methods | 3 | I | I | I |
| MA404 | Probability | 3 | I | I | I |
| MA407 | Differential Equations | 4 | R | R | I |
| FI402 | Physics III | 4 | R | R | I |
| MA406 | Multivariable Calculus | 5 | R | R | I |
| MC401 | Introduction to Mechanical Engineering | 1 | I | I | I |
| MF400 | Materials Properties | 2 | I | I | I |
| MF401 | Materials Manufacturing | 3 | I | I | I |
| MC402 | Mechanics of Materials | 4 | R | R | I |
| MF402 | Computer Aided Fabrication | 4 | R | R | I |
| MC403 | Fluid Mechanics | 5 | R | R | R |
| MC404 | Introduction to Design | 5 | R | R | R |
| MC405 | Physical Metalurgy | 5 | R | R | R |
| MC406 | Finite Modelling | 6 | R | R | R |
| MC407 | Electro-Pneumatic and Hydraulic Systems | 6 | R | R | R |
| MC408 | Thermodynamics | 6 | R | R | R |
| MC409 | Design Engineering | 7 | E | E | E |
| MC410 | Dynamics of Mechanisms | 7 | E | E | E |
| MC411 | Automation and Control | 7 | E | E | E |
| MC412 | Mechanical Experimental Analysis | 8 | E | E | E |
| MC413 | Plant Engineering | 8 | E | E | E |
| MC414 | Heat Transfer | 8 | E | E | E |
| | Elective I | 7 | E | E | E |
| | Elective II | 8 | E | E | E |
| | Emphasis Elective I (AED, AMD) | 5 | R | R | R |
| | Emphasis Elective II (AED, AMD) | 6 | R | R | R |
| | Emphasis Elective III (AED, AMD) | 7 | E | E | E |
| | Emphasis Elective IV (AED, AMD) | 8 | E | E | E |

| ELECTRONIC CYBERNETICS ENGINEERING | | | LEARNING OUTCOMES FOR ALL ENGINEERING PROGRAMS | | |
|---|---|---|---|---|---|
| CURRICULAR ELEMENTS | | | SLO_ENG1 | SLO_ENG2 | SLO_ENG3 |
| CODE | COURSE | SEMESTER | LEVEL | LEVEL | LEVEL |
| MA400 | Mathematics for University | 1 | I | I | I |
| CC400 | Programming Methods I | 1 | I | I | I |
| MC400 | Computer Aided Drawing | 1 | I | I | I |
| MA401 | Differential Calculus | 1 | I | I | I |
| CC402 | Programming Methods II | 2 | I | I | I |
| FI400 | Physics I | 2 | I | I | I |
| MA402 | Integral Calculus | 2 | I | I | I |
| FI401 | Physics II | 3 | I | I | I |
| MA403 | Numerical Methods | 3 | I | I | I |
| MA404 | Probability | 3 | I | I | I |
| MA407 | Differential Equations | 4 | R | R | I |
| FI402 | Physics III | 4 | R | R | I |
| MA405 | Statistical Inference | 5 | R | R | I |
| CE403 | Introduction to Electronic Cybernetics | 1 | I | I | I |
| CE404 | Digital Electronics I | 2 | I | I | I |
| CE405 | Digital Electronics II | 3 | I | I | I |
| CE406 | Computer Architecture | 4 | R | R | I |
| CE407 | Electrical Circuits | 4 | R | R | I |
| CC404 | Data Structures | 5 | R | R | I |
| CC406 | Operating Systems | 5 | R | R | R |
| CE408 | Analog Electronics I | 5 | R | R | R |
| CE409 | Microprocessor Design | 6 | R | R | R |
| CE410 | Analog Electronics II | 6 | R | R | R |
| CE411 | Control Systems | 6 | R | R | R |
| CE412 | Interface Design | 7 | E | E | E |
| CE413 | Computer Networks | 7 | E | E | E |
| CE414 | Power Electronics | 7 | E | E | E |
| CC414 | Selected Topics in Programming | 8 | E | E | E |
| CE402 | Computer Network Applications | 8 | E | E | E |
| CE415 | Mechatronics | 8 | E | E | E |
| | Elective I | 7 | E | E | E |
| | Elective II | 8 | E | E | E |
| | Emphasis Elective I (MSC, RIA, BIO) | 5 | R | R | R |
| | Emphasis Elective II (MSC, RIA, BIO) | 6 | R | R | R |
| | Emphasis Elective III (MSC, RIA, BIO) | 7 | E | E | E |
| | Emphasis Elective IV (MSC, RIA, BIO) | 8 | E | E | E |

| COMPUTER SCIENCE ENGINEERING | | | LEARNING OUTCOMES FOR ALL ENGINEERING PROGRAMS | | |
|---|---|---|---|---|---|
| CURRICULAR ELEMENTS | | | SLO_ENG1 | SLO_ENG2 | SLO_ENG3 |
| CODE | COURSE | SEMESTER | LEVEL | LEVEL | LEVEL |
| MA400 | Mathematics for University | 1 | I | I | I |
| CC400 | Programming Methods I | 1 | I | I | I |
| MC400 | Computer Aided Drawing | 1 | I | I | I |
| MA401 | Differential Calculus | 1 | I | I | I |
| CC402 | Programming Methods II | 2 | I | I | I |
| FI400 | Physics I | 2 | I | I | I |
| MA402 | Integral Calculus | 2 | I | I | I |
| FI401 | Physics II | 3 | I | I | I |
| MA403 | Numerical Methods | 3 | I | I | I |
| MA404 | Probability | 4 | I | I | I |
| FI402 | Physics III | 4 | R | R | I |
| MA405 | Statistical Inference | 5 | R | R | I |
| MA406 | Multivariable Calculus | 5 | R | R | I |
| CC401 | Introduction to Computer Sciences | 1 | I | I | I |
| CC403 | Computer Systems and Components | 2 | I | I | I |
| CC404 | Data Structures | 3 | I | I | I |
| CC405 | Analysis and Design of Algorithms | 4 | R | R | I |
| SI400 | Database Design | 4 | R | R | I |
| CE400 | Computer Conteol | 5 | R | R | R |
| CC406 | Operating Systems | 5 | R | R | R |
| CC407 | Advanced Programming | 5 | R | R | R |
| CC408 | Analysis and Design of Information Systems | 6 | R | R | R |
| CC409 | Database Systems | 6 | R | R | R |
| CC410 | Automata Theory | 6 | R | R | R |
| SI401 | Software Development Processes | 7 | E | E | E |
| CC411 | Compiler Design | 7 | E | E | E |
| CE401 | Computer Networks | 7 | E | E | E |
| CC412 | Topics in Distributed Systems | 8 | E | E | E |
| CE402 | Computer Networks Applications | 8 | E | E | E |
| CC413 | Artificial Intelligence | 8 | E | E | E |
| | Elective I | 7 | E | E | E |
| | Elective II | 8 | R | R | R |
| | Emphasis Elective I (VGD, SWD, BPA) | 5 | R | R | R |
| | Emphasis Elective II (VGD, SWD, BPA) | 6 | R | R | R |
| | Emphasis Elective III (VGD, SWD, BPA) | 7 | E | E | E |
| | Emphasis Elective IV (VGD, SWD, BPA) | 8 | E | E | E |

| MECHATRONICS ENGINEERING | | | LEARNING OUTCOMES FOR ALL ENGINEERING PROGRAMS | | |
|---|---|---|---|---|---|
| CURRICULAR ELEMENTS | | | SLO_ENG1 | SLO_ENG2 | SLO_ENG3 |
| CODE | COURSE | SEMESTER | LEVEL | LEVEL | LEVEL |
| MA400 | Mathematics for University | 1 | I | I | I |
| CC400 | Programming Methods I | 1 | I | I | I |
| MC400 | Computer Aided Drawing | 1 | I | I | I |
| MA401 | Differential Calculus | 1 | I | I | I |
| CC402 | Programming Methods II | 2 | I | I | I |
| FI400 | Physics I | 2 | I | I | I |
| MA402 | Integral Calculus | 2 | I | I | I |
| FI401 | Physics II | 3 | I | I | I |
| MA403 | Numerical Methods | 3 | I | I | I |
| MA404 | Probability | 3 | I | I | I |
| MA407 | Differential Equations | 4 | R | R | I |
| FI402 | Physics III | 4 | R | R | I |
| MA406 | Multivariable Calculus | 5 | R | R | I |
| CE058 | Introduction to Mechatronics | 1 | I | I | I |
| MF400 | Materials Properties | 2 | I | I | I |
| MF401 | Materials Manufacturing | 3 | I | I | I |
| MF402 | Computer Based Manufacturing | 4 | R | R | I |
| MC402 | Mechanics of Materials | 4 | R | R | I |
| MC410 | Dynamics of Mechanisms | 5 | R | R | R |
| CE059 | Electronic Systems I | 5 | R | R | R |
| MC404 | Introduction to Design | 5 | R | R | R |
| CE061 | Automation and Industrial Robotics | 6 | R | R | R |
| MC407 | Electro-Pneumatic ans Hydraulic Systems | 6 | R | R | R |
| CE060 | Electronic Systems II | 6 | R | R | R |
| CE062 | Programmable Controllers | 7 | E | E | E |
| CE414 | Power Electronics | 7 | E | E | E |
| CE063 | Sensors and Actuators | 7 | E | E | E |
| CE401 | Computer Networks | 7 | E | E | E |
| CE402 | Computer Network Applications | 8 | E | E | E |
| CE065 | Microcontroller Based Design | 8 | E | E | E |
| CE064 | Mechatronics Protoype Modelling | 8 | E | E | E |
| MC414 | Heat Transfer | 8 | E | E | E |

| DIGITAL GRAPHIC DESIGN ENGINEERING | | | LEARNING OUTCOMES FOR ALL ENGINEERING PROGRAMS | | |
|---|---|---|---|---|---|
| CURRICULAR ELEMENTS | | | SLO_ENG1 | SLO_ENG2 | SLO_ENG3 |
| CODE | COURSE | SEMESTER | LEVEL | LEVEL | LEVEL |
| DG400 | Introduction to digital graphical design | 1 | I | I | I |
| CC400 | Programming Methods I | 1 | I | I | I |
| MA400 | Mathematics | 1 | I | I | I |
| MC400 | Computer Aided Drawing | 1 | I | I | I |
| CC402 | Programming Methods II | 2 | I | I | I |
| MA410 | Selected Subjects of Math I | 2 | I | I | I |
| DG431 | Contemporaneous Styles | 2 | I | I | I |
| DG432 | Natural drawing | 2 | I | I | I |
| MA411 | Selected Subjects of Math I | 3 | I | I | I |
| CC416 | Multimedia Programming | 3 | I | I | I |
| DG433 | Visual Composition | 3 | I | I | I |
| CC417 | Ilustration and Animation for 2D | 3 | I | I | I |
| DG441 | Design Methodology | 4 | R | R | I |
| FI403 | Conceptual Phisics | 4 | R | R | I |
| CC421 | Computer Graphics | 4 | R | R | I |
| DG434 | General Typography | 4 | R | R | I |
| CC403 | Computationals Systems and Components | 4 | R | R | I |
| DG435 | Global Image Manual | 5 | R | R | R |
| DG436 | Digital Photography | 5 | R | R | R |
| CC404 | Data Structures | 5 | R | R | R |
| MA413 | Probability and Statistics | 5 | R | R | R |
| SI403 | Databases | 6 | R | R | R |
| DG437 | Design for Electronics Media | 6 | R | R | R |
| MK400 | Administración de mercadotecnia | 6 | R | R | R |
| DG418 | Video Production | 7 | E | E | E |
| DG438 | Digital Modeling | 7 | E | E | E |
| CC406 | Operating Systems | 7 | E | E | E |
| DG419 | Multimedia | 7 | E | E | E |
| DG420 | Animation for 3D | 8 | E | E | E |
| CE417 | Networks and data transmision | 8 | E | E | E |
| DG439 | Electronics Commerce | 8 | E | E | E |
| DG440 | Strategic Business Devolpment | 8 | E | E | E |

| SOFTWARE ENGINEERING | | | LEARNING OUTCOMES FOR ALL ENGINEERING PROGRAMS | | |
|---|---|---|---|---|---|
| CURRICULAR ELEMENTS | | | SLO_ENG1 | SLO_ENG2 | SLO_ENG3 |
| CODE | COURSE | SEMESTER | LEVEL | LEVEL | LEVEL |
| MA400 | Matemathics for University | 1 | I | I | I |
| CC400 | Programming Methods I | 1 | I | I | I |
| MC400 | Computer Aided Draw | 1 | I | I | I |
| MA401 | Differential Calculus | 1 | I | I | I |
| CC402 | Programming Methods I | 2 | I | I | I |
| FI400 | Phisics I | 2 | I | I | I |
| MA402 | Integral Calculus | 2 | I | I | I |
| FI401 | Phisics II | 3 | I | I | I |
| MA403 | Numerical Methods | 3 | I | I | I |
| MA404 | Probability | 3 | I | I | I |
| FI402 | Phisics III | 4 | R | R | I |
| MA405 | Statistics Inference | 5 | R | R | I |
| MA406 | Multivariable Calculus | 5 | R | R | I |
| CC089 | Introduction to software engineering | 1 | I | I | I |
| CC403 | Computationals Systems and Components | 2 | I | I | I |
| CC404 | Data Structures | 3 | I | I | I |
| CC082 | Software Engineering I | 4 | R | R | I |
| SI400 | Database Design | 4 | R | R | I |
| CC084 | Software Engineering II | 5 | R | R | R |
| CC406 | Operating Systems | 5 | R | R | R |
| CC083 | Programming and mobil computing | 5 | R | R | R |
| CC090 | Software project management | 6 | R | R | R |
| CC409 | Database Systems | 6 | R | R | R |
| CC084 | Software Engineering III | 6 | R | R | R |
| CC087 | Business Intelligence Systems | 7 | E | E | E |
| CC091 | Agile Systems Development | 7 | E | E | E |
| CE401 | Computer Networks | 7 | E | E | E |
| CC092 | Information Technology Management | 8 | E | E | E |
| CE066 | Network management and Security | 8 | E | E | E |
| CC088 | Distributed Computing Technology | 8 | E | E | E |
| | Elective I | 7 | E | E | E |
| | Elective II | 8 | E | E | E |
| | Emphasis Elective I (VGD, BPA) | 5 | R | R | R |
| | Emphasis Elective II (VGD, BPA) | 6 | R | R | R |
| | Emphasis Elective III (VGD, BPA) | 7 | E | E | E |
| | Emphasis Elective IV (VGD, BPA) | 8 | E | E | E |

It is important to note that, for all academic programs, 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.

## 3. Assessment Plan for August-December 2010.

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 in two stages, the first to be deployed during the second semester of 2010 focuses on program level learning outcomes common to all engineering program. The second stage focuses on program level outcomes specific to the academic program, as well as external assessment data relating to the EGEL exit examination 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 courses 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 process and methodology that was defined consists of 6 key components:

1) Selection of Learning Outcomes: Each Academy, based upon the set of Program Level Learning Outcomes (common and specific) defined for the academic programs, will select at least one learning outcome to assess during each assessment cycle.

2) Course selection for assessment: Based upon the curriculum, and curricular mapping, each Academy, with the aid of the Deans of the Schools of Engineering, will define in which courses the assessment process will be implemented. It is important that the selected courses span the length of the academic program.

3) Design of Instruments for Assessment: Each Academy will design or select instruments to assess the selected learning outcomes. Examples of these may be various types of rubrics. Participation of various faculty members is not only encouraged, but strongly recommended.

4) Definition of learning activities and evidence of learning: Once learning outcomes, and courses are defined, learning activities and their corresponding evidence of learning are identified and defined. The congruency between this and the instruments defined in 3) is important. Both 3) and 4) may be done concurrently.

5) Training of faculty: With the aid of the Deans of the Schools of Engineering, faculty who will participate in assessment during the cycle are provided training regarding terminology, methodology as well as the instruments to be used. Close collaboration with faculty is key to the success of the process.

6) Assessment during semester: The learning outcomes are assessed in the selected courses, using the defined instruments for the learning activities and corresponding

learning evidence. This part of the process is supervised by the Deans of the Schools of Engineering in each Campus.

7) Analysis of results: At the end of the cycle, results are presented to the Academies and analyzed to identify areas of opportunity to be included as a part of the program review process.

Assessment Plan for the August-December 2010 semester.

1) Selection of Learning Outcomes: The Academies decided that, for this first assessment cycle, all programs would assess the first two Program Level Learning Outcomes that are common to all Engineering Programs, meaning SLO_ENG1 and SLO_ENG2.

   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.

2) Course selection for assessment: Based upon the course offering for the August-December 2010 semester, courses were selected for assessment. Since institutional learning outcomes assessment was also being done during the same semester, courses were selected with an effort to have compatibility and congruency with the institutional level assessment process, and also so as to not overburden faculty members.

   The complete set of courses offered by the College of Engineering during the August-December 2010 semester is listed in the next page (including the curricular mapping for SLO_ENG1 and SLO_ENG2), in which each course has a color that identifies it as "belonging" to one of the 6 academies of the College of Engineering:

   1. **Academy of Industrial Engineering.** This Academy is responsible for the Industrial Engineering Program (offered in the three Campuses). The chair of this Academy is M.S. Socorro Lomelí (Ensenada Campus).

   2. **Academy of Computer Science and Software.** This Academy is responsible for the Computer Science Engineering Program (offered in the Mexicali and Tijuana Campuses), and the Software Engineering Program (offered in the Ensenada Campus). The chair of this Academy is M.S. Guillermo Cheang (Mexicali Campus).

   3. **Academy of Cybernetics and Mechatronics.** This Academy is responsible for the Electronic Cybernetics Engineering Program and Mechatronics Engineering Programs (both are offered in the three Campuses). The chair of this Academy is M.S. Cristóbal Capiz (Mexicali Campus).

   4. **Academy of Mechanical Engineering.** This Academy is responsible for the Mechanical Engineering Program (offered in the three Campuses). The chair of this Academy is M.S. Bernardo Valadez (Mexicali Campus).

5. **Academy of Digital Graphic Design Engineering.** This Academy is responsible for the Digital Graphic Design Engineering Program (offered in the three Campuses). The chair of this Academy is M.S. Fabian Bautista (Tijuana Campus).

6. **Academy de Basic Sciences.** This is the only Academy that is not responsible for an academic program, but is responsible in overseeing the Basic Sciences courses offered in all the Engineering academic programs. This Academy works with all the other Academies and is chaired by M.S. Salvador Baltazar (Mexicali Campus).

**Courses offered by the College of Engineering – August-December 2010**

| COURSE ID | NAME | SEMESTER | ACADEMIC PROGRAMS | SLO_ENG1 | SLO_ENG2 |
|---|---|---|---|---|---|
| MA400 | Mathematics for University | 1 | ICE, ICC, II, IM, ISW, IMEC, IDGD | I | I |
| CC400 | Programming Methods I | 1 | ICE, ICC, II, IM, ISW, IMEC, IDGD | I | I |
| CE403 | Introduction to Electronic Cybernetics | 1 | ICE | I | I |
| CC401 | Introduction fo Computer Science | 1 | ICC | I | I |
| II400 | Introduction to Industrial Engineering | 1 | II | I | I |
| MC401 | Introduction to Mechanical Engineering | 1 | IM | I | I |
| CE058 | Introduction to Mechatronics | 1 | IMEC | I | I |
| CC089 | Introduction fo Software Engineering | 1 | ISW | I | I |
| DG400 | Introduction to Digital Graphic Design | 1 | IDGD | I | I |
| FI401 | Physics II | 3 | ICE, ICC, II, IM, ISW, IMEC, IDGD | I | I |
| MA403 | Numerical Methods | 3 | ICE, ICC, II, IM, ISW, IMEC, IDGD | I | I |
| CE405 | Digital Electronics II | 3 | ICE | I | I |
| MF401 | Materials Manufacturing | 3 | II, IM, IMEC | I | I |
| MA411 | Selected Topics in Mathematics | 3 | IDGD | I | I |
| CC416 | Multimedia Programming | 3 | IDGD | I | I |
| DG433 | Visual Composition | 3 | IDGD | I | I |
| CC417 | Ilustration and animation in 2D | 3 | IDGD | I | I |
| CC404 | Data Structures | 3 | ICE (5), ICC, ISW, IDGD (5) | I | I |
| MA405 | Statistical Inference | 5 | ICE, ICC, II, ISW | R | R |
| MA406 | Multivariable Calculus | 5 | ICC, II, IM, ISW, IMEC | R | R |
| CE408 | Analog Electronics II | 5 | ICE | R | R |
| CE400 | Computer Based Control | 5 | ICC | R | R |
| CC407 | Advanced Programming | 5 | ICC | R | R |
| II403 | Industrial Electronics | 5 | II | R | R |
| II404 | Methods Engineering | 5 | II | R | R |
| MC403 | Fluid Mechanics | 5 | IM | R | R |
| MC404 | Introduction to Design | 5 | IM, IMEC | R | R |
| MC405 | Physical Metalurgy | 5 | IM | R | R |
| CE059 | Electronic Systems I | 5 | IMEC | R | R |
| CC084 | Software Engineering II | 5 | ISW | R | R |
| CC083 | Mobile Computing and Programming | 5 | ISW | R | R |
| DG435 | Global Image Manual | 5 | IDGD | R | R |
| DG436 | Digital Photography | 5 | IDGD | R | R |
| MA413 | Probability & Statistics | 5 | IDGD | R | R |
| CC406 | Operating Systems | 5 | ICE, ICC, ISW, IDGD (7) | R | R |
| CE412 | Interface Design | 7 | ICE | E | E |
| CE413 | Computer Networks | 7 | ICE, ICC, ISW, IMEC | E | E |
| CE414 | Power Electronics | 7 | ICE, IMEC | E | E |
| SI401 | Software Development Process | 7 | ICC | E | E |
| CC411 | Compiler Design | 7 | ICC | E | E |
| II408 | Production Systems Engineering II | 7 | II | E | E |
| II409 | Design of Experiments | 7 | II | E | E |
| II410 | Operations Research Models II | 7 | II | E | E |
| MC409 | Design Engineering | 7 | IM | E | E |
| MC411 | Automation & Control | 7 | IM | E | E |
| CE062 | Programmable Controllers | 7 | IMEC | E | E |
| CE063 | Sensors & Actuators | 7 | IMEC | E | E |
| CC087 | Intelligent Systems for Business | 7 | ISW | E | E |
| CC091 | Rapid System Design | 7 | ISW | E | E |
| DG418 | Video Production | 7 | IDGD | E | E |
| DG438 | Digital Modelling | 7 | IDGD | E | E |
| DG419 | Multimedia | 7 | IDGD | E | E |
| MC410 | Mechanisms Dynamics | 7 | IM, IMEC (5) | E | E |

The academic programs are:

- ✓ II = Industrial Engineering
- ✓ IM = Mechanical Engineering
- ✓ ICC = Computer Science Engineering

- ✓ ICE = Electronic Cybernetics Engineering
- ✓ IMEC = Mechatronics Engineering
- ✓ ISW = Software Engineering
- ✓ IDGD = Digital Graphic Design Engineering

The levels used for the curricular mapping of SLO_ENG1 and SLO_ENG 2 are INTRODUCTORY (I), REINFORCEMENT (R) and EVALUATION (E), explained in section 2 of this document.

From the complete course listing for the August-December 2010 semester, a subset of courses was selected for assessment, following the criteria that these courses should span all academic programs, as well as all semesters. The following list shows the subset of 16 selected courses:

| COURSE ID | NAME | SEMESTER | ACADEMIC PROGRAMS | SLO_ENG1 | SLO_ENG2 |
|---|---|---|---|---|---|
| CC400 | Programming Methods I | 1 | ICE, ICC, II, IM, ISW, IMEC, IDGD | I | I |
| FI401 | Physics II | 3 | ICE, ICC, II, IM, ISW, IMEC, IDGD | I | I |
| MF401 | Materials Manufacturing | 3 | II, IM, IMEC | I | I |
| CC416 | Multimedia Programming | 3 | IDGD | I | I |
| MA405 | Statistical Inference | 5 | ICE, ICC, II, ISW | R | R |
| MC404 | Introduction to Design | 5 | IM, IMEC | R | R |
| MA413 | Probability & Statistics | 5 | IDGD | R | R |
| CC406 | Operating Systems | 5 | ICE, ICC, ISW, IDGD (7) | R | R |
| CE413 | Computer Networks | 7 | ICE, ICC, ISW, IMEC | E | E |
| CE414 | Power Electronics | 7 | ICE, IMEC | E | E |
| SI401 | Software Development Process | 7 | ICC | E | E |
| II409 | Design of Experiments | 7 | II | E | E |
| II410 | Operations Research Models II | 7 | II | E | E |
| MC409 | Design Engineering | 7 | IM | E | E |
| CC091 | Rapid System Design | 7 | ISW | E | E |
| DG438 | Digital Modelling | 7 | IDGD | E | E |

3) Design of Instruments for Assessment: Each Academy made proposals for instruments to be used to assess SLO_ENG1 and SLO_ENG2, and these were analyzed and integrated, resulting in the definition of two rubrics, a holistic one for SLO_ENG1 and an analytical one for SLO_ENG2. Each rubric document begins with a cover page with the following information:

CETYS UNIVERSIDAD
COLLEGE OF ENGINEERING

ASSESSMENT OF PROGRAM LEVEL LEARNING OUTCOMES

AUGUST-DECEMBER 2010

Course Name and ID: _____

Name of Faculty Member: _____

Student Information:

| Student ID(s) | Names(s) | Program(s) |
|---|---|---|
| | | |

Comments and observations:

| |
|---|
| |

The holistic rubric designed to assess SLO_ENG1 was the following:

| SLO_ENG1 – HOLISTIC RUBRIC – PROBLEM IDENTIFICATION, DEFINITION AND SOLVING | |
|---|---|
| SLO_ENG1: The student of a CETYS University Bachelor's in Engineering Program will solve problems relating to the improvement of diverse systems, correctly applying the knowledge and tools provided by the basic sciences and/or software technologies. | |
| **Level** | **Criteria** |
| **0**<br><br>**INSUFFICIENT (at least one applies)** | The student:<br>➢ Cannot identify the problem.<br>➢ Cannot explain or define the problem.<br>➢ Cannot identify elements and characteristics of the problem (variables, inputs, outputs, parameters, processes etc.).<br>➢ Cannot identify the areas of knowledge or theoretical and conceptual framework associated with the problem.<br>➢ Cannot identify knowledge, tools, or methodologies of the basic sciences, required to solve the problem.<br>➢ Cannot identify the tools, or software technologies required to solve the problem.<br>➢ Cannot derive a solution to the problem. |
| **1**<br><br>**INTRODUCTORY (most apply)** | The student:<br>➢ Identifies the problem.<br>➢ Can partially explain the problem, but cannot define it completely.<br>➢ Identifies some elements and characteristics of the problem (variables, inputs, outputs, parameters, processes, etc.) but cannot relate them.<br>➢ Identifies the areas of knowledge as well as the theoretical and conceptual framework associated with the problem, but does not know how to relate these to solve the problem.<br>➢ Identifies knowledge, tools and methodologies of the basic sciences, required to solve the problem, but cannot use them correctly nor efficiently to solve the problem.<br>➢ Identifies tools and software technologies required to solve the problem, but does not know how to use them correctly nor efficiently to solve the problem.<br>➢ Derives a solution to the problem but not necessarily via the correct path and the solution is not necessarily the most efficient one. |
| **2**<br><br>**REINFORCEMENT (most apply)** | The student:<br>➢ Identifies the problem.<br>➢ Can explain the problem and define it completely.<br>➢ Identifies elements and characteristics of the problem (variables, inputs, outputs, parameters, processes, etc.) and knows how to relate them.<br>➢ Identifies the areas of knowledge as well as the theoretical and conceptual framework associated with the problem and knows how to relate them to solve the problem.<br>➢ Identifies the knowledge, tools and methodologies of the basic sciences required to solve the problem, and uses them correctly, but not necessarily in the most efficient manner to solve the problem.<br>➢ Identifies the tools and software technologies required to solve the problem and uses the correctly, but not necessarily in the most efficient manner to solve the problem.<br>➢ Derives a solution to the problem via the correct path however the solution is not necessarily the most efficient one. |
| **3**<br><br>**EVALUATION (all apply)** | The student:<br>➢ Identifies the problem.<br>➢ Can explain the problem and define it completely.<br>➢ Identifies elements and characteristics of the problem (variables, inputs, outputs, parameters, processes, etc.) and knows how to relate them.<br>➢ Identifies the areas of knowledge as well as the theoretical and conceptual framework associated with the problem and knows how to relate them to solve the problem.<br>➢ Identifies the knowledge, tools and methodologies of the basic sciences required to solve the problem, and uses them correctly and in the most efficient manner to solve the problem.<br>➢ Identifies the tools and software technologies required to solve the problem and uses the correctly and in the most efficient manner to solve the problem.<br>➢ Derives a solution to the problem via the correct path obtaining the most efficient solution. |

**Level: _____**

The analytic rubric designed to assess SLO_ENG2 was the following:

| SLO_ENG2 – ANALYTIC RUBRIC – PROJECT MANAGEMENT. | | | | |
|---|---|---|---|---|
| **SLO_ENG2: The student of a CETYS University Bachelor's in Engineering Program will effectively design and manage projects.** | | | | |
| **CATEGORY (20% each)** | **Criteria** | | | |
| | **0 INSUFFICIENT (0-25 points)** | **1 INTRODUCTORY (26-50 points)** | **2 REINFORCEMENT (51-75 points)** | **3 EVALUATION (76-100 points)** |
| **1) Planning and organization** | No planning was done. Review and due dates were not taken into account. Time, resources and eventualities were not considered. No resource definition or planning was done. | Little planning was done and only in relation to the due date, without consideration to time and resources or eventualities. Little resource planning was done, however not adequately. | Planning was done but only in relation to the due date, with some consideration to time and resources or eventualities. Resource planning was done adequately, however not in the most efficient manner. | Planning was done taking into account the due date, as well as review dates, taking into account time and resources, as well as eventualities. Resource planning was done in an adequate and efficient manner. |
| **2) Design and implementation** | No design was done and the implementation does not reflect the use of engineering methodologies or tools. | A preliminary design was done and the implementation reflects the original design only partially. The design reflects partial use of engineering methodologies and tool, with considerable areas of improvement and/or limited functionality. | A preliminary design was done and the implementation reflects the design, as well as the use of engineering methodologies and tools, however with limited functionality. | A preliminary design was done and the implementation reflects the design, as well as the correct use of engineering methodologies and tools, with complete functionality. |
| **3) Testing and troubleshooting** | No tests or troubleshooting was done. | Test and troubleshooting were done only when the final implementation did not achieve the desired functionality, and no satisfactory explanation is given with regards to the lack of functionality. | Test and troubleshooting were done throughout the development of the project, identifying and correcting errors, but without a systematic process and little understanding of the troubleshooting process or why the lack of functionality occurs. | Testing and troubleshooting were done in a systematic manner throughout the development of the project, identifying and correcting errors, with a clear understanding of the reasons for the lack of functionality and the troubleshooting process. |
| **4) Documentation** | No documentation was done. | Documentation was done only in relation to the final design without documenting the previous research, planning, preliminary design, development, testing and troubleshooting. | Documentation was done for the final design with some information regarding previous research, planning, preliminary design, development, testing and troubleshooting. | Complete documentation was done which includes not only the final design, but also previous research, planning, preliminary design, development, testing and troubleshooting. |
| **5) Achievement of goals** | Goals were not achieved. | Goals were partially achieved. | Goals were achieved but not in a timely manner. | Goals were achieved in a timely manner. |

**Global points (0-100): _____** **Level: _____**

4) Definition of learning activities and evidence of learning: The 16 courses were divided between each Academy, according to areas of knowledge, and each Academy worked with their faculty members to identify learning activities and evidence of learning that could be used for the assessment of SLO_ENG1 and SLO_ENG2, considering the normal coursework that faculty do during a regular semester in which the courses are offered, and also in congruency with the instruments defined in 3) Each academy delivered a learning activity and evidence of learning description document. Following the same mentality described in 2), activities were selected in which both SLO_ENG1 and SLO_ENG2 could be assessed (and if possible, also institutional learning outcomes). It is not surprising that most activities follow a project and/or problem based learning scheme.

   The following table shows a brief description of the learning activities defined by each academy for the selected courses:

| COURSE ID | NAME | LEARNING ACTIVITY | EVIDENCE OF LEARNING |
|---|---|---|---|
| CC400 | Programming Methods I | Final projectin teams consisting in the design and implementation (programming) of a simple registry query system. | Written report, presentation of final project. |
| FI401 | Physics II | Laboratory exercise in teams consisting of demonstrating Newton's second law using various experimental methods | Written report, presentation of lab exercise. |
| MF401 | Materials Manufacturing | Final project in teams consisting in the design and fabrication of a product that is eco-friendly. | Written report, presentation of final project. |
| CC416 | Multimedia Programming | Final project in teams consisting in developing an interactive application using Flash. | Written report, presentation of final project. |
| MA405 | Statistical Inference | Final project in teams consisting in analyzing a system using statistical methods to identify and justify improvements. | Written report, presentation of final project. |
| MC404 | Introduction to Design | Final project in teams consisting in the development of a Mechanical Design Library software. | Written report, presentation of final project. |
| MA413 | Probability & Statistics | Solving of a defined problem in teams using probability and statistical methods. | Written report of problem solution and procedure. |
| CC406 | Operating Systems | Final project in teams consisting in developing a software program using threads and/or memory management for a non-Windows based operating system. | Written report, presentation of final project. |
| CE413 | Computer Networks | Solving a defined problem in teams that has to do with communication between two computer systems and the configuration of a computer network, | Written report of problem solution and procedure. |
| CE414 | Power Electronics | Solving of a defined problem in teams that has to do with the use of high currents in an electronic device. | Written report of problem solution and procedure. |
| SI401 | Software Development Process | Final project in teams that consists in correctly following a software development methodology and process. | Written report, presentation of final project. |
| II409 | Design of Experiments | Final project in teams that consists in the design and implementation of a statistical analysis test for the improvement of a system. | Written report, presentation of final project. |
| II410 | Operations Research Models II | Final project in teams that consists in the analysis of a queue system using probabilistic methods. | Written report, presentation of final project. |
| MC409 | Design Engineering | Final project in teams consisting in the design of a gear system with all necesary specifications. | Wirtten report, presentation of final project. |
| CC091 | Rapid System Design | Final project in teams that consists in the development of a software solution using rapid system design methodologies | Written report, presentation of final project. |
| DG438 | Digital Modelling | Design in teams of three 3D models using Maya software. | Presentation of designs. |

Additional support documentation for faculty was developed by the academies for each of the proposed learning activities. This documentation explains in further detail the characteristics of the learning activity and evidence of learning.

5) Training of faculty: With the aid of the Deans of the Schools of Engineering, each Campus trained the group of faculty who would teach the selected courses during the August-December 2010 semester, and therefore would participate in assessment during the cycle.

6) Assessment during semester: The assessment cycle was deployed during the August-December 2010 semester and results, including evidence of learning, were gathered by each School Director for each Campus.

7) Analysis of results: The results were analyzed by each Academy during the first semester of 2011. (The results are integrated into the corresponding Program Review document).

For following assessment cycles, it is expected that an assessment scheme that allows for assessment of institutional and both program level types of learning outcomes be designed, however, the bulk of workload that this would imply needs to be analyzed with detail.

## 4. Assessment Plan for January-June 2011.

The second stage of the assessment plan focuses on program level outcomes specific to the academic program.

Each Academy first defines the program level specific learning outcomes to be assessed, and then goes through the following stages:

1. Definition of rubrics.
   Faculty from each campus 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 courses where assessment will be applied.
   Based upon the curricular mapping for the academic program, courses 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 select learning activities and evidence for assessment, according to the selected course 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 evaluate and provide feedback to students.
   Faculty evaluate student work using the previously designed rubrics and provide feedback to the students, as well as a general summary of assessment results.

8. Faculty generate a summary of assessment results.
   Each faculty member generates a summary of assessment results for student learning based upon the selected course 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?

NOTE: The results are integrated into the corresponding Program Review document.

ASSESSMENT DATA FROM EXTERNAL SOURCES.

It is necessary to identify additional objective metrics to include in the design and deployment of assessment plans and programs. Currently, last-year students present an undergraduate exit examination (EGEL) administered by CENEVAL (an organization in México that offers various examination services), and designed by academics from different universities all over Mexico.

CENEVAL (National Center for Evaluation of Higher Education) in México has developed a series of instruments to evaluate basic knowledge for professionals that have concluded their academic programs. The instrument is called EGEL (Undergraduate Exit Examination) and has specific versions designed for various academic programs, using a scale that measures professional requirements established by industry and government, for new professionals.

In CETYS, graduating undergraduate students do the EGEL examination in their last semester of studies, and the results obtained are an external indicator that provides important information for program review, and specifically learning outcomes and educational objectives analysis, as well as modifications to the curriculum.

Since 2006, systematic information regarding the EGEL examination is available for analysis, and up until 2009, the EGEL examination evaluated areas specific to the academic program with a focus on knowledge evaluation.

The global CENEVAL index was evaluated using three levels of achievement: ANS (Unsatisfactory Achievement), DS (Satisfactory Achievement) and DSS (Outstanding Achievement).

In the year 2010, the EGEL examination was modified to evaluate knowledge and abilities for professionals, with a competencies based focus.

Each Academy analyzed the results of the EGEL examination for their academic program, as an external source for assessment information.

NOTE: The results are integrated into the corresponding Program Review document.