ALIGNING THE COMPUTER ENGINEERING DEPARTMENT WITH ABET EC 2K

Computer Engineering Department

King Fahd University of Petroleum and Minerals

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ABET EC 2K
Motivation

ABET EC 2K

- **Cost of education (mid 90's): More than 15% of median family income**
- **Industry mutation: Engineers should be educated in a way to facilitate their adaptation to important industry mutation (Bio, Nano, Health, Comp. Technology, change in products, etc)**
- **(not to be tight to one original area of formation)**
- **Demographic issues, population aging, etc.**

ABET EC 2K

- Shift in Engineering Education
  - Teacher-Centered Focus
    - Traditional classroom
    - Distance learning using synchronous video-conferencing
  - Learner-Centered Focus (outcome-based)
    - Interactive multimedia
    - Educational solutions designed by multi-skilled academic teams
    - Asynchronous learning (any time and anywhere)
- Since 1995 a shift in ABET criterion: “A meaningful, major engineering design experience …”
- Pilote ABET visits in 96-98, required to meet EC 2K by 2001

Where did EC2K Come From? Early 1990s

- NSF Study
- Dean's Council (American Society for Engineering Education)
- National Research Council
- Much industrial involvement
- Led directly to EC2000
- EC 2K New Paradigm:
  - Demands will be for the solution of problems involving human values, attitudes, behavior
  - And interrelationships and dynamics of social, political, environmental, and economic systems
  - And on a global basis

New Paradigm

- **Emphasis on inquiry-based learning**
- **Preparation for lifelong learning**
- **Stress integrative, systems thinking**
- **Coping with change**
- **Communications skills, including listening**
- **Group skills, identification through finish**
- **Ecoefficient design—focus on design issues involving life-cycle economics, environmental impact, sustainable development, ethics, timeliness, quality, health & safety, manufacturability, social, legal, standards, and ad hoc concerns.**
- **Continuous Process Improvement (as in Baldridge, ISO 9000, etc)**

Some Results

- **More emphasis on "soft skills"—with no decrease in technical content**
  - **Communication**
  - **Lifelong Learning**
  - **Multidisciplinary**
  - **Teamwork**
  - **Ethics and Professionalism**
- **Emphasis on learning, not teaching**
- **And design……..Program Outcomes and Assessment (Criterion 4):**
  - **…major design experience based on the knowledge and skills acquired in earlier course work and incorporating engineering standards and realistic constraints that include most of the following considerations: economic; environmental; sustainability; manufacturability; ethical; health and safety; social; and political.**

Program Outcomes and Assessment (2004/5)

- **Some Outcomes are Easily Understood and Implemented**
  - **a: Science, Mathematics, Engineering**
  - **b: Experiments**
  - **c: Design**
  - **e: Solve engineering problems**
  - **k: Modern tools (software)**
- **Others Present New Challenges**
  - **d: Multidisciplinary**
  - **f: Professional, ethical**
  - **g: Communicate**
  - **h: Broad education, societal, global**
  - **i: Lifelong learning**
  - **j: Contemporary issues**

ABET EC 2K PROGRAM OUTCOMES AND OUTCOMES ASSESSMENT (2004/5)

Criterion 1: Students

- **The quality and performance of the students are important in the evaluation of an engineering program.**
- **The institution must:**
  - **evaluate, advise, and monitor students to determine its success in meeting program objectives.**
  - **have and enforce policies for the acceptance of transfer students and for the validation of courses taken for credit elsewhere.**
  - **enforce procedures to assure that all students meet all program requirements.**

Criterion 2. Program Educational Objectives

- **The program educational objectives describe the expected accomplishments of graduates during the first several years following graduation from the program. (NEW)**
- **An engineering program must have in place:**
  - **Published educational objectives that are consistent with the mission**
  - **a process based on the needs of the program's various constituencies in which the objectives are determined and periodically evaluated**

Criterion 2. Program Educational Objectives (Cont'd)

- **A curriculum and processes that prepare students for the achievement of these objectives (REVISED)**
- **A system of ongoing evaluation that demonstrates achievement of these objectives and uses the results to improve the effectiveness of the program.**

Criterion 3. Program Outcomes and Assessment

- The program outcomes are intended to be statements that describe what students are expected to know or be able to do by the time of graduation from the program. (NEW)

- Engineering programs must demonstrate that their graduates have:
  - **(a) an ability to apply knowledge of mathematics, science, and engineering**
  - **(b) an ability to design and conduct experiments, as well as to analyze and interpret data**

Criterion 3. Program Outcomes and Assessment

- **(c) an ability to design a system, component, or process to meet desired needs**
- **(d) an ability to function on multi-disciplinary teams**
- **(e) an ability to identify, formulate, and solve engineering problems**
- **(f) an understanding of professional and ethical responsibility**

Criterion 3. Program Outcomes and Assessment

- **(g) an ability to communicate effectively**
- **(h) the broad education necessary to understand the impact of engineering solutions in a global and societal context**
- **(i) a recognition of the need for, and an ability to engage in life-long learning**
- **(j) a knowledge of contemporary issues**
- **(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.**

Criterion 4. Professional Component (Curriculum)

- **Specify subject areas appropriate to engineering but do (not courses)**
- **The curriculum devotes adequate attention and time to each component, consistent with the objectives of the program and institution.**
- **Students must be prepared for engineering practice:**
  - **a curriculum culminating in a major design experience based on the knowledge and skills from earlier course work**
  - **incorporating engineering standards: economic; environmental; sustainability; manufacturability; ethical; health and safety; social; and political.**

Criterion 4. Professional Component (Curriculum)

- **The professional component must include:**
  - **(a) one year of a combination of college level mathematics and basic sciences**
  - **(b) one and one-half years of engineering topics, consisting of engineering sciences and engineering design**
  - **(c) a general education component that complements the technical content of the curriculum and is consistent with the program and institution objectives.**

Criterion 4. Professional Component (Curriculum)

- **ABET 2004-2005 criteria added just before a-k:**
  - **Each program must formulate program outcomes that foster attainment of the program objectives.**
  - **Design requirements strengthened again:**
    - **There must be processes to produce these outcomes and an assessment process, with documented results, that demonstrates that these program outcomes are being measured and indicates the degree to which the outcomes are achieved.**
    - **There must be evidence that the results of this assessment process are applied to the further development of the program.**

Proposed Changes 2005-2006

- **There must be processes to produce these outcomes and an assessment process, with documented results, that demonstrates that these program outcomes are being measured and indicates the degree to which the outcomes are achieved. There must be evidence that the results of this assessment process are applied to the further development of the program.**

Criterion 5. Faculty

- **The faculty must be of sufficient number; and**
- **Must have the competencies to cover all of the curricular areas of the program.**
- **There must be sufficient faculty to accommodate:**
  - **adequate levels of student-faculty interaction,**
  - **student advising and counseling,**
  - **university service activities,**
  - **professional development, and**
  - **interactions with industrial and professional practitioners, as well as employers of students.**

Criterion 5. Faculty (Cont'd)

- **The program faculty must have appropriate qualifications and demonstrate sufficient authority to:**
  - **Ensure the proper guidance of the program,**
  - **Develop and implement processes for the evaluation, assessment, and continuing improvement of the program, its educational objectives and outcomes.**
- **The factors determining faculty competence:**
  - **Education and diversity of backgrounds,**
  - **Engineering experience and teaching experience,**
  - **Ability to communicate, enthusiasm for developing more effective programs,**
  - **level of scholarship, participation in professional societies, and registration as Professional Engineers.**

Criterion 6. Facilities

- **Classrooms, laboratories, and associated equipment must be adequate to accomplish the program objectives and provide an atmosphere conducive to learning.**
- **Appropriate facilities must be available to foster faculty-student interaction and to create a climate that encourages professional development and professional activities.**
- **Programs must provide opportunities for students to learn the use of modern engineering tools.**
- **Computing and information infrastructures must be in place to support the scholarly activities of the students and faculty and the educational objectives of the institution.**

Criterion 7. Institutional Support and Financial Resources

- **Institutional support, financial resources, and constructive leadership must be adequate to assure the quality and continuity of the engineering program.**
- **Resources must be sufficient to attract, retain, and provide for the continued professional development of a well-qualified faculty.**
- **Resources also must be sufficient to acquire, maintain, and operate facilities and equipment appropriate for the engineering program.**
- **In addition, support personnel and institutional services must be adequate to meet program needs.**

Criterion 8. Program Criteria

- Distinguish branches of engineering
- In EE and Computer Engineering
  - Breadth and depth
  - Ability to analyze and design complex devices, software, and systems
- In Electrical Engineering
  - Knowledge of Advanced Mathematics
- In Computer Engineering
  - Knowledge of Discrete Mathematics

Criterion 8. Program Criteria

- These exist for all branches of engineering, e.g. ME, IE, ChemE, Civil, etc.
- These deal with faculty qualifications and with curricular matters

ALIGNING THE COMPUTER ENGINEERING DEPARTMENT WITH ABET EC 2K

INSTITUTION VISION

- KFUPM vision

  To be a vibrant multicultural University of international repute focuse on quality education and innovative research that prepares professionals and entrepreneurs to lead social, economic and technical development in the region.

- CCSE main objectives:
  - To provide the skilled manpower needed for the fulfillment of the country's development plans. In particular: information & computer scientists, computer engineers, and systems engineers.
  - To prepare students for graduate work and research in their field of specialization.
  - To provide a link through which computer technologies and their applications could be transferred to the country.
  - To provide the country, through research and graduate studies, with skills, ideas, and innovations in certain areas of advanced technologies.

EDUCATIONAL OBJECTIVES

- The objectives of the COE program

  To produce computer engineering graduates prepared to:

  - Objective 1: Practice their profession with confidence and global competitiveness and make intellectual contributions to it;
  - Objective 2: Pursue a life-long career of personal and professional growth with superior work ethics and character and
  - Objective 3: Pursue advanced study and research at the graduate level.

Program Outcomes

- (a) an ability to apply knowledge of mathematics, science, and engineering
- (b) an ability to design and conduct experiments, as well as to analyze and interpret data
- (c) an ability to design a system, component, or process to meet desired needs
- (d) an ability to function on multi-disciplinary teams

  Our interpretation of multidisciplinary teams includes teams of individuals with similar educational backgrounds focusing on different aspects of a project as well as teams of individuals with different educational backgrounds.
- (e) an ability to identify, formulate, and solve engineering problems

Program Outcomes (Cont)

- (f) an understanding of professional and ethical responsibility
- (g) an ability to communicate effectively
- (h) the broad education necessary to understand the impact of engineering solutions in a global and societal context
- (i) a recognition of the need for, and an ability to engage in life-long learning

  Our interpretation of this includes teaching students that the underlying theory is important because the technology will change, coupled with enhancing their self-learning ability.

Program Outcomes (Cont)

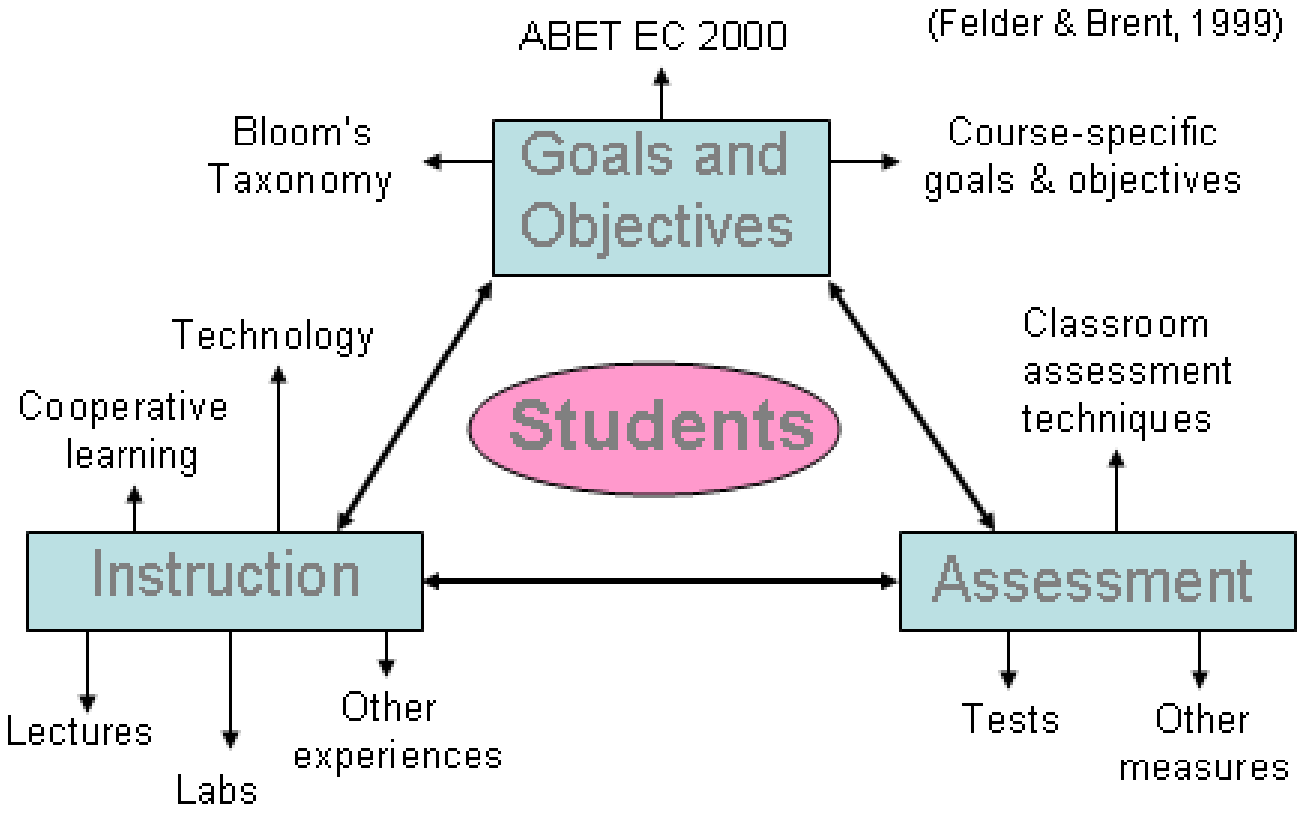
- (j) knowledge of contemporary issues

  Our interpretation of this includes presenting students with issues such as the impact of globalization, the outsourcing of both engineering and other support jobs as practiced by modern international companies.
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- (l) Knowledge of Probability and Statistics and their applications in Computer Engineering
- (m) Knowledge of Discrete Mathematics
- (n) The ability to design a system that involves the integration of hardware and software components

Relation of Program Outcomes and Educational Objectives

Program Educational Objectives	Program Outcomes
1. Practice profession with confidence and global competitiveness and make intellectual contributions to it	a, b, c, d, e, g, k, l, m , n
2. Pursue a life-long career of personal and professional growth with superior work ethics and character	f, i, h, j
3. Pursue advanced study and research at the graduate level	a, b, e, g, i, k

Effective Course Design



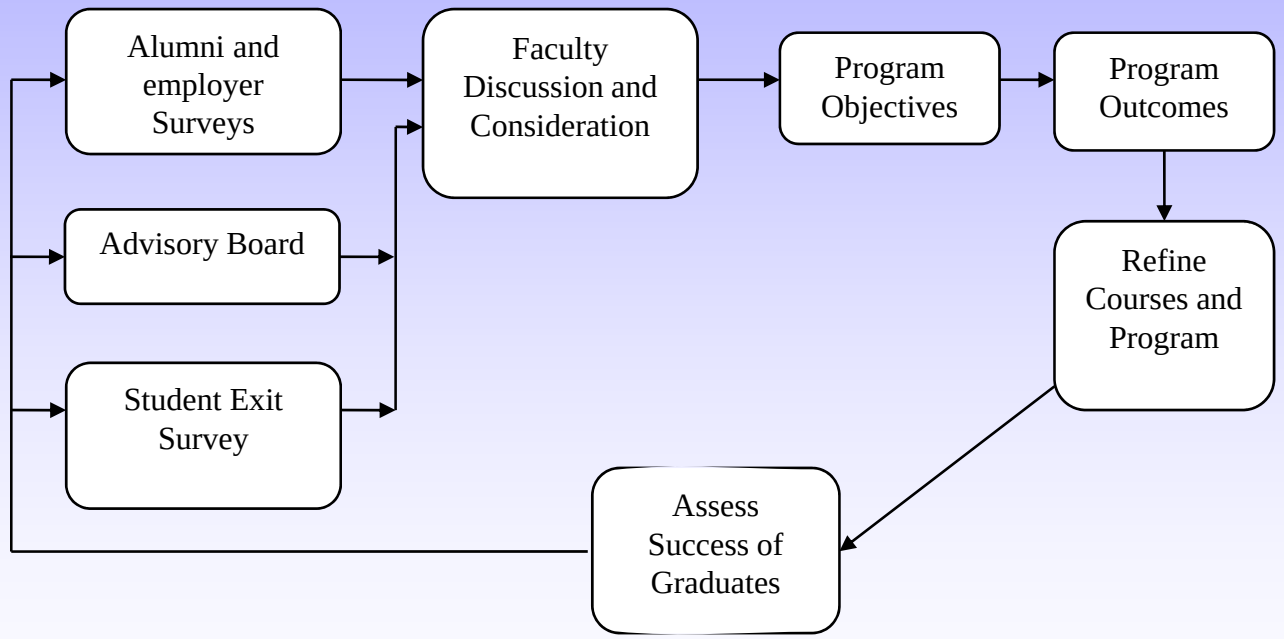
Program Outcomes Coverage in Curriculum

- Program outcomes are injected and well covered by core courses in the program curriculum.
- Each program outcome is addressed by a set of core courses in the program.
- Learning outcomes of core courses mapped to program outcomes with a level of emphasis being either low (L), medium (M), or High (H).
- Level of emphasis for an outcome is determined based on the weight as follows:
  - Course outcome weight $< 10\%$, given a Low rank (L).
  - Course outcome weight between 10% and 20% given a Medium rank (M).
  - Course outcome weight $\geq 20\%$ given a High rank (H).

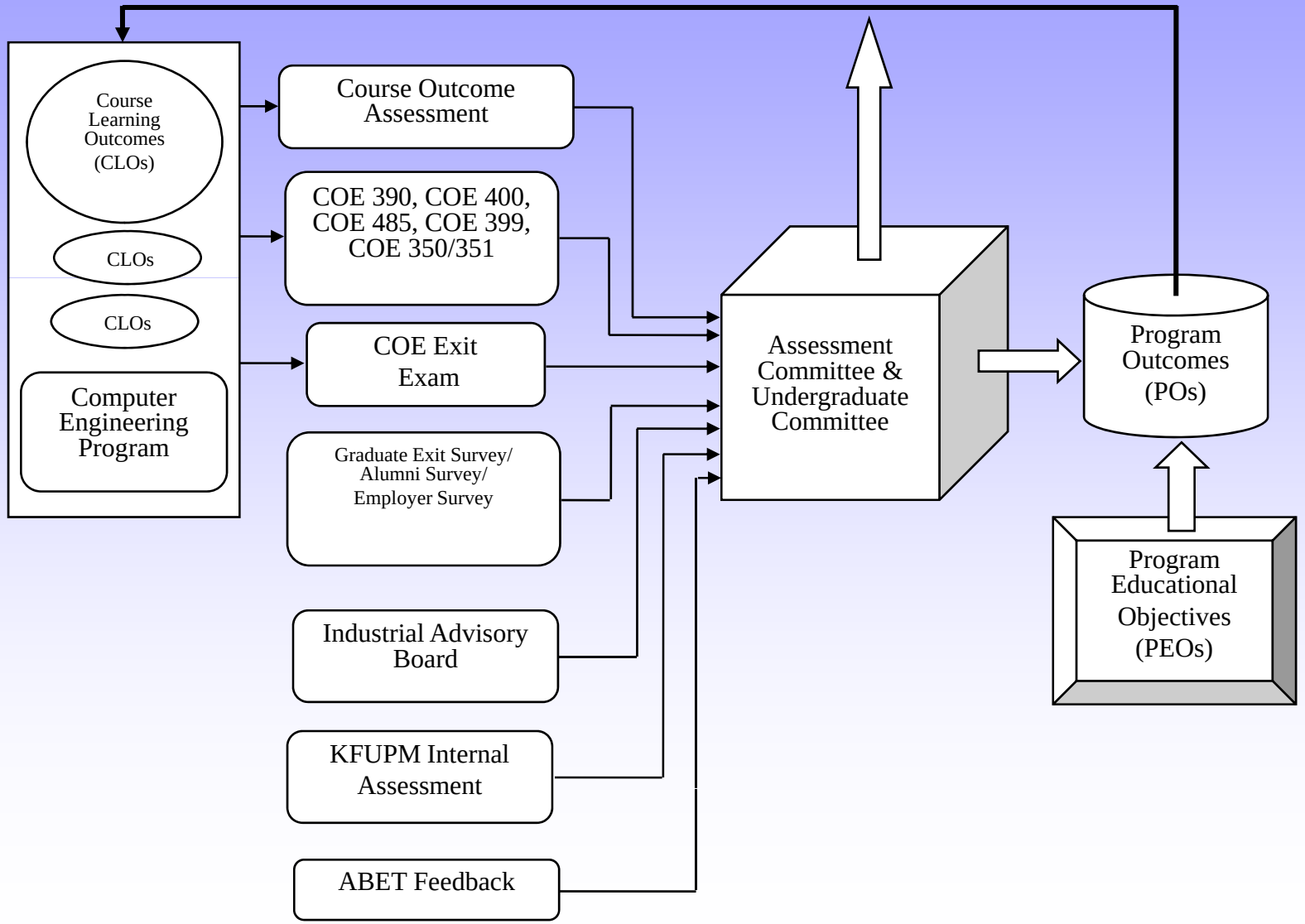
Program Outcomes Coverage in Curriculum

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
COE 202	H		H								L			
COE 203		M	H	L			L				H			
COE 205			H	L					L		L			
COE 305	M	L	H	L	H				L		L			
COE 308	H		H		L				L		L			
COE 341	M		H		H				L		L			
COE 344	M	L			H					L	L			
COE 360	L	L	H	L			L				M			
COE 390						M	H	L	M	M				
COE 400	M	M		M	L		M		L		L			H
COE 485	L	M	H	M	L	L	M	L	L	L	M			
COE 351			H	M		M	H		M		M			
COE 399				M		M	H		M		H			
STAT 319												H		
ICS 252													H	
IAS 211						H								
ENGL 214							H							

Program Educational Objectives Assessment Process



Program Outcomes Assessment



Assessment Method

- **Indirect Assessement**
  - Industrial Advisory Board
  - Employer Survey
  - Alumni Survey
  - Graduate Exit Survey
  - Student Survey (course)

- **Direct Assessement**
  - Computer Engineering Exit Exam
  - Rubrics
    - Microcomputer System Design (COE 305) lab (outcome b)
    - Computer Networks lab (COE 344) lab (outcome b)
    - Cooperative Work (COE 350/351) (outcomes a, c, d, e, g, h, i, j, k, and n)
    - Seminar (COE 390) (outcome f)
    - Summer Training (COE 399) (outcome g)
    - System Design Laboratory (COE 400) (outcomes (a, b, c, d, e, g, h, i, j, k, n)
    - Senior Design Project (COE 485) (outcomes a, c, d, e, g, h, i, j, k, and n)
  - Course Assessemnt
    - All COE core courses

What is a Rubric

- A scoring tool that
  - lists the criteria for a piece of work, or "what counts"
    - » For example, purpose, organization, details, voice, and mechanics are often what count in a piece of writing
  - describes levels of quality for each criterion
    - » For example, qualitative scores (e.g. Excellent, Good, Satisfactory, Needs Improvement), or as numerical scores (e.g., 4, 3, 2, 1)

* Heidi Goodrich Andrade, a rubrics expert (http://learnweb.harvard.edu/alps/thinking/docs/rubricar.htm)

Why use Rubrics

- Rubrics help students and teachers define “quality”
- When students use rubrics regularly to judge their own work, they begin to accept more responsibility for the end product
- Rubrics reduce the time teachers spend grading student work and makes it easier for teachers to explain to students why they got the grade they did and what they can do to improve

* Heidi Goodrich Andrade, a rubrics expert (http://learnweb.harvard.edu/alps/thinking/docs/rubricar.htm)

How Rubrics are used in COE

- As presented earlier, for each COE program outcome, an assessment and evaluation plan is developed that contains the following elements:
  - Assessment and Evaluation Methods
  - Performance Criteria
  - Logistics
- “Rubrics” are one of the direct assessment methods used to evaluate the COE program outcomes
- A “Rubric” exists for each of the following COE program outcomes:
  - a, b, c, d, e, f, g, h, i, j, k, and n

Program Outcomes Assessment Process

- Two committees to conduct assessment process, assessment committee and undergraduate committee.

- Assessment committee responsible of
  - design and control of the direct and indirect assessment processes,
  - data collection and presentation,
  - data delivery to undergraduate committee.

- Undergraduate Committee responsible of
  - Carrying out analysis of direct and indirect assessment data provided by the Assessment Committee and the Faculty based on course assessment results.
  - identify potential problems and suggest recommendations for making improvements.
  - Implementing approved recommendations.

Course Outcomes Assessment Process

- Each COE course has a Course Learning Outcomes Table that includes the following for each outcome:
  - Outcome indicators and details: this describes the main course topics that will be focused on to achieve the outcome.
  - Suggested assessment methods and metrics.
  - Outcome minimum weight: this indicates the importance of the outcome in the course. It is the minimum weight from the total course score (out of 100) that must be used for assessing the outcome or covering the outcome in the course.
  - A mapping between the course learning outcome and ABET program outcomes.
  - Each outcome is given a rank as Low, High, Medium that correlates with the weight used for assessing the outcome.

Course Outcomes Assessment Process

- Course outcomes are assessed by course instructors both directly and indirectly.
- Suggested direct assessment of course learning outcomes based on using Course Learning Outcomes Evaluation Table includes the following for each outcome:
  - Outcome minimum weight.
  - Outcome weight: this is to be filled by the instructor indicating how much weight was used by the instructor for assessing the outcome.
  - Assessment Method: this describes what methods were used to asses the outcome, the weight of each method, and the evidence of assessment.
  - Class Average: indicates the student's average performance in the outcome.

Course Learning Outcomes Table Example of COE 205

Course Learning Outcomes	Outcome Indicators and Details	Assessment Methods and Metrics	Min. Weight	ABET 2000 Criteria
1. Ability to analyze, design, implement, and test assembly language programs.	Instruction Set Architecture Number (unsigned and signed) and character representation Addressing modes Syntax, semantics, and effect on flags of Pentium instructions. Input/output. Arithmetic and logic operations. Flow-control structures. Procedures. Macros. String manipulation. Interrupt mechanism. Implementation of Pseudo code algorithms in assembly language.	Assignment Quizzes Exams Project	55%	C(H)

Course Learning Outcomes Table Example of COE 205

Course Learning Outcomes	Outcome Indicators and Details	Assessment Methods and Metrics	Min. Weight	ABET 2000 Criteria
2. Ability to use tools and skills in analyzing and debugging assembly language programs.	Assembly language vs. machine language. Assembling and linking assembly programs (including use of multiple files). Use of debugger to analyze and debug programs. Use of libraries.	Lab work	4%	K(L)
3. Ability to design the datapath and control unit of a simple CPU.	Fetch-execute cycle Data, address and control busses Register transfer Data path design: 1-bus, 2-bus and 3-bus CPU. Derivation of control steps for assembly instructions. Hardwired Control unit design Microprogrammed control unit design. Fixed vs. variable instruction format.	Assignments Quizzes Exams	15%	C(M)

Course Learning Outcomes Table Example of COE 205

Course Learning Outcomes	Outcome Indicators and Details	Assessment Methods and Metrics	Min. Weight	ABET 2000 Criteria
4. Ability to demonstrate self-learning capability.	Ability to learn a course topic alone (e.g. Macros) Course Project may involve topics not studied in the course	Assignment Quizzes	2%	I(L)
5. Ability to work in a team.	Project is divided into separate parts that will be integrated for project completion.	Project	2%	D(L)

Course Learning Outcomes Evaluation Table Example (COE 205)

Outcome	Outcome Min. Weight	Assessment Method								
		Assign.	Quizz	Exam I	Exam II	Exam III	Final Exam	Lab Work	Proj.	Total
O1	55%	15%	8%	15%	20%			5%	8%	71%
	Average	12.1%	5.3%	9.5%	12.1%			4.1%	7%	50.1%(70.6%)
	Evidence	#1-4	#1-4, 6	Q1-5	Q1-5			#1-13	Rep.	
O2	4%							5%		5%
	Average							4.1%		4.1% (82%)
	Evidence							#1-13		
O3	15%						20%			20%
	Average						11.8%			11.8% (59%)
	Evidence						Q1-5			

Course Learning Outcomes Evaluation Table Example of COE 205

Outcome	Outcome Min. Weight	Assessment Method								
		Assign.	Quiz	Exam I	Exam II	Exam III	Final Exam	Lab Work	Proj.	Total
O4	2%		2%							2%
	Avg.		1.3%							1.3% (65%)
	Eviden.		#5							
O5	2%								2%	2%
	Avg.								1%	1% (50%)
	Eviden.								Rep.	
Weight		15%	10%	15%	20%		20%	10%	10%	100%
Average		12.1%	6.6%	9.5%	12.1 %		11.8 %	8.2%	8%	68.3%

Course Learning Outcomes Indirect Assessment Example of COE 205

Criteria	Student Evaluation					
	E (4)	G (3)	A (2)	P (1)	NA (0)	Composite
1. As a result of this course, my ability to analyze, design, implement, and test assembly language programs can be described as,	10	5	3	2		3.15
2. As a result of this course, my ability to use tools and skills in analyzing and debugging assembly language programs can be described as,						0
3. As a result of this course, my ability to design the datapath and control unit of a simple CPU can be described as,						0
4. As a result of this course, my ability to demonstrate self-learning capability can be described as,						0
5. As a result of this course, my ability to work in a team can be described as,						0
	Number of Responses: 20					

Course Assessment Results
Example of COE 205

Section#	Source of Outcome Data	Outcome1	Outcome2	Outcome3	Outcome4	Outcome5
I	Instructor Evaluation	64.8%	48.2%	72.3%	62.8%	61.7%
	Student Survey	75%	65%	68.2%	73.3%	75%
II	Instructor Evaluation	77.8%	80.7%	70.1%	75.2%	75.2%
	Student Survey	88.25%	88.25%	69%	75%	86.8%
III	Instructor Evaluation	77.4%	86%	77.5%	78%	78.8%
	Student Survey	87%	79%	77.8%	81.5%	80.3%
Overall	Recommend.	Acceptable	Needs Improvem.	Needs Improvem.	Acceptable	Acceptable

Course Assessment Results
Example of COE 205

- Observations:
  - Outcome 2 and Outcome 5 have not been assessed directly in Section II and Section III and the lab mark has been used.
  - Based on the overall assessment and instructors feedback, it seems that Outcome 2 and Outcome 3 need improvement. All Other outcomes are considered well-achieved.
- Recommendations:
  - Outcome 2 needs more emphasis in the lab and should be directly assessed by lab instructors.
  - Outcome 3 can be improved by increasing the number of assignments on this part from one to two.

Program Outcomes Assessment

- For each program outcome, an assessment and evaluation plan is developed that contains the following elements:
  - Assessment and Evaluation Methods: This describes what assessment methods are used to collect data and how will the data be evaluated and interpreted.
  - Performance Criteria: This determines the criteria used to indicate that an outcome has been achieved with satisfactory levels or needs improvement.
  - Logistics: This indicates when the data will be collected and who will collect it, interpret it, and report the results.

Industry Advisory Board

- Attend Advisory Board regular meeting
- Review of department area of concentrations and recommend some enhancement to undergraduate program in some specialized areas
- Provide inputs on the undergraduate student qualifications and skills based on new trends and local industry needs
- Provide feedback on the Educational Objectives and Program Outcomes and their implications on the program curriculum.
- Consideration of the level of support provided to faculty to further their professional development, research, and teaching goals,
- Survey the board members regarding their views on the importance of each aspect of the program departmental Educational Objectives.

Program Outcomes Assessment

Program Outcome	Assessment & Evaluation Methods	Performance Criteria	Logistics
(a) an ability to apply knowledge of mathematics, science, and engineering	• Samples of COE 400, COE 485 and COE 351 reports • Math 101, Math 102, Math 201, Math 260, Phys. 101, Phys. 102, chem.. 101 • Exit exam • Graduate Exit Survey • Coop Employer Survey	• A score ≥ 2.5 out of 4 • Average GPA ≥ 2.5 out of 4 • A score ≥ 60% • A score ≥ 3 out of 5 • A score ≥ 3 out of 5	Assessments will be conducted every semester. However, grades of Math, Phys. & Chem. Courses will be collected and analyzed once a year.
(b) an ability to design and conduct experiments, as well as to analyze and interpret data	• Samples of COE 400, COE 344 and COE 305 lab reports • Graduate Exit Survey • Coop Employer Survey	• A score ≥ 2.5 out of 4 • A score ≥ 3 out of 5 • A score ≥ 3 out of 5	Assessments will be conducted every semester.

Program Outcomes Assessment

Program Outcome	Assessment & Evaluation Methods	Performance Criteria	Logistics
(c) an ability to design a system, component, or process to meet desired needs	Samples of COE 400, COE 485 and COE 351 reports Graduate Exit Survey Coop Employer Survey	A score ≥ 2.5 out of 4 A score ≥ 3 out of 5 A score ≥ 3 out of 5	Assessments will be conducted every semester.
(d) an ability to function on multi-disciplinary teams	Samples of COE 400, COE 485 and COE 351 reports Peer & instructor evaluations in COE 400 Graduate Exit Survey Coop Employer Survey	A score ≥ 2.5 out of 4 A score ≥ 2.5 out of 4 A score ≥ 3 out of 5 A score ≥ 3 out of 5	Assessments will be conducted every semester.

Summary

- The COE department defined its mission, vision, educational objectives, and educational outcomes.
- Two departmental committees will be in charge of the process of periodically assessing the program, provide input data on how to tune the COE program, and carry out correction action at all levels.
- The COE department is determined to improve its program both the technical and behavioral components to meet EC 2K
- New instruction techniques for outcome-based education will be gradually introduced at all levels to improve the quality of the Computer Engineer to some international standard.
- The Industrial Advisory Board is one important channel to provide the department with feedback on the achievement of long term educational objectives as experienced by our COE alumni

COE RUBRICS
ASSESSMENT PROCESS

Outline

- What is a Rubric
- Why use Rubrics
- How Rubrics are used in COE
  - » Process
  - » Samples
- Currently available “Rubrics” results
- Summary

How Rubrics are used in COE

1) The following COE courses are used to assess the COE program outcomes, and accordingly have an associated set of Rubrics:

   - Microcomputer System Design (COE 305) lab (outcome b)
   - Computer Networks lab (COE 344) lab (outcome b)
   - Cooperative Work (COE 350/351) (outcomes a, c, d, e, g, h, i, j, k, and n)
   - Seminar (COE 390) (outcome f)
   - Summer Training (COE 399) (outcome g)
   - System Design Laboratory (COE 400) (outcomes (a, b, c, d, e, g, h, i, j, k, n)
   - Senior Design Project (COE 485) (outcomes a, c, d, e, g, h, i, j, k, and n)

1) An equivalent summary is provided in the following slide

How Rubrics are used in COE

Course	Rubrics to be Used for Outcome											
	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*n*
COE 305		×										
COE 344		×										
COE 351	×		×	×	×		×	×	×	×	×	×
COE 390						×						
COE 399							×					
COE 400	×	×	×	×	×		×	×	×	×	×	×
COE 485	×		×	×	×		×	×	×	×	×	×

1) Note the following:

i. COE 399 is used for COE program assessment through "Rubrics" only once a year (i.e. in the 1st term)

ii. All other courses are used for COE program assessment through "Rubrics" twice a year (i.e. in the 1st and the 2nd terms)

How Rubrics are used in COE
The Process

1) The instructor of each of the COE 305 lab, COE 344 lab, COE 399, COE 400, and COE 485 as well as each member of the examining committee of COE 399 and COE 350/351 is responsible for performing the following:

   - Select a sample of students from their respective course
   - Conduct the respective "Rubrics" using the selected sample of the students from the previous step
   - Forward the results of the conducted "Rubrics" to the COE Assessment Committee (AC)

2) The AC collects the various results of "Rubrics" associated with each COE program outcome, and accordingly calculates a weighted average, out of 4.0, for each COE program outcome
3) Forward "Rubrics" summary results to the Undergraduate Committee (UC) to consider curriculum correction actions, if any

   - From "Rubrics" point of view, a COE program outcome is declared to be achieved if the corresponding weighted average is ≥ 2.5 out of 4.0

How Rubrics are used in COE

- The following slides provide a sample of the “Oral Presentation Rubrics” used to assess COE program outcome (g)

Oral Presentation Rubrics (Sample)

ORAL PRESENTATION ASSESSMENT

Presenter's Name: _____ Presenter ID#: _____
Presentation Title: _____
Evaluator's Name: _____ Date: _____

Outcome	Novice (1)	Apprentice (2)	Proficient (3)	Exemplary (4)	Score	Comments
•**Audience awareness** (interacts with audience: e.g. stepping toward audience and speaking to them, not at them), looking at them, making eye contact	Does not interact with audience at all … Does not look at the audience … Look at PC, screen, or elsewhere	Little interaction with audience … Most of the time looks elsewhere	Some interaction with audience	Interacts with audience throughout presentation		
•**Focus**: goal, evidence, conclusion (gives audience a roadmap and follows it)	Does not give audience an adequate road map of goal, evidence and conclusion	Gives audience some road map of goal, evidence and conclusion	Gives audience an adequate road map of goal, evidence and conclusion	Gives audience very clear road map of goal, evidence and conclusion		
•**Transitions** (phrases smoothly link one part to next)	Abruptly transitions from one phase to the next … No linking	Some transition is provided though not smooth	Transitions are generally smooth	Very smooth Transitions		
•**Use of visual aids (any non-plain text methods such as graphs, charts, flow diagrams …etc.)** to tell the story and enhance the quality of the presentation	Either does not use visual aids at all; or too much dependency on visual aids	There is some use visual aids effectively to tell the story	Overall, uses visual aids effectively to tell the story; visual aids add to presentation	Uses visual aids very effectively to tell the story; visual aids enhance presentation		

Oral Presentation Rubrics (Sample)

Mechanics	Novice (1)	Apprentice (2)	Proficient (3)	Exemplary (4)	Score	Comments
•**Body position** (e.g., facing audience or screen)	Body position (faces screen or board all the time)	Body position (faces audience some of the time)	Body position (faces audience most of the time)	Body position (always facing audience)		
•**Eye contact**: (e.g., scanning entire audience)	No eye contact	Some eye contact (not enough, looking down a lot)	Eye contact (some scanning of audience, looking at people)	Eye contact (excellent scanning of audience, looking at people)		
•**Visual aids** (e.g., clear, not too busy, readable size font)	Visual Aids (too busy, blurry)	Visual Aids (a little bit busy, sometimes not clear)	Visual Aids (can read clearly, usually not too much material)	Visual Aids (clear, right amount on each slide)		
•**Delivery** (e.g., fluency, pace, voice projection, um's, uh's)	Delivery (too fast, too many um's, not projecting voice, lack of enthusiasm)	Delivery (a little bit fast, sometimes um's, little projecting voice, little enthusiasm)	Delivery (good pace, usually projects voice, some enthusiasm)	Delivery (excellent pace, projects voice, great enthusiasm)		

Questions	Novice (1)	Apprentice (2)	Proficient (3)	Exemplary (4)	Score	Comments
•**Asks audience for questions**	Does not ask for questions	rarely ask for questions	Asks for questions	Effectively opens ("I'd be happy to answer questions")		
•**Answers questions effectively and smoothly**	Does not answer questions adequately	rarely answer questions adequately	Answers questions adequately	Answers questions effectively and smoothly		

Currently Available Rubrics Results

- The COE program outcomes “Rubrics” have been conducted for both T062 and T071
- The summary results for both T062 and T071 are provided next

T062 Rubrics Results

Course	Students Sample Count	Outcome Rubrics													
		a	*b*	*c*	*d-I*	*d-II*	*e*	*f*	*g-O*	*g-W*	*h*	*i*	*j*	*k*	*n*
COE 305	3		3.17												
COE 344	6		3.29												
COE 351	18 (g-O) 3 (a,c) 0 (d-I) 4 (others)	2.11		2.60		3.13	2.38		2.81	2.53	2.75	2.66	2.75	2.75	2.50
COE 390	24							2.58							
COE 400	1 (g-O) 2 (b,k,n) 3 (others)	2.33	3.21	2.25	3.24	3.33	2.83		3.80	1.92	1.56	2.50	1.33	3.25	2.50
COE 485	4 (g-O) 0 (d-I) 1 (others)	4.00		3.60	0.00	3.00	4.00		2.75	3.67	3.33	3.83	3.00	4.00	4.00
Average	*2.73*	*2.47*	*3.24*	*2.59*	*3.24*	*3.19*	*2.75*	*2.58*	*2.84*	*2.44*	*2.38*	*2.75*	*2.25*	*3.07*	*2.71*

Missing

d-I : outcome (d) - Part I (peer evaluation)
d-II : outcome (d) - Part II (instructor evaluation)
g-O : outcome (g) - Oral Presentation
g-W : outcome (g) - Writing Skills

T071 “Rubrics” Results

Course	Students Sample Count	Outcome Rubrics													
		a	*b*	*c*	*d-I*	*d-II*	*e*	*f*	*g-O*	*g-W*	*h*	*i*	*j*	*k*	*n*
COE 305	5		3.60												
COE 344	3		3.08												
COE 351	10 (g-O) 6 (g-W) 3 (others)	1.82		2.13		0.00	2.38		2.81	2.77	2.30	2.90	2.50	2.40	2.32
COE 390	6							3.50							
COE 399	24 (g-O) 16 (g-W)								2.72	2.45					
COE 400	4 (a,e,d-I) 1 (g-O) 5 (others)	1.75	2.80	2.36	2.39	2.80	3.00		3.80	2.64	1.80	3.00	1.20	2.60	2.70
COE 485	1 (a,d-I) 2 (d-II,j) 5 (g-O) 3 (others)	3.00		2.57	3.00	3.50	3.50		2.90	2.27	2.11	3.28	2.00	2.83	3.00
Average	*2.64*	*1.93*	*3.17*	*2.35*	*2.51*	*3.00*	*2.90*	*3.50*	*2.79*	*2.53*	*2.02*	*3.05*	*1.75*	*2.61*	*2.68*

Missing

d-I : outcome (d) - Part I (peer evaluation)
d-II : outcome (d) - Part II (instructor evaluation)
g-O : outcome (g) - Oral Presentation
g-W : outcome (g) - Writing Skills

Currently Available Rubrics Results

- To explain the weighted average "Rubrics" score for an outcome, consider outcome (c) in the T071 results
- "Rubrics" for outcome (c) were conducted using COE 350/351, COE 400, and COE 485 with students' sample of 3, 5, and 3, respectively, and with an average result of 2.13, 2.36, and 2.57, respectively
- Weighted average score for outcome (c) = $(3\times2.13 + 5\times2.36 + 3\times2.57)/(3+5+3) = 2.35$

Currently available Rubrics results

Term	Outcome Rubrics											
	a	b	c	d	e	f	g	h	i	j	k	n
T071 Average	1.93	3.17	2.35	2.76	2.90	3.50	2.66	2.02	3.05	1.75	2.61	2.68
T062 Average	2.47	3.24	2.59	3.21	2.75	2.58	2.64	2.38	2.75	2.25	3.07	2.71

- By comparing the rubrics results for both T062 and T071, the following can be concluded from a "Rubrics" point of view:
  - COE program outcomes (b), (d), (e), (f), (g), (i), (k), and (n) were achieved
  - COE program outcomes (a), (c), (h), and (j) were not achieved

Summary

- Rubrics are used as one method to directly assess the COE program outcomes
- A process is defined to explain how to conduct the “Rubrics” every term
- The “Rubrics” were conducted for T062 and T071
- “Rubrics” results for T062 and T071 reflect that the COE program outcomes (b), (d), (e), (f), (g), (i), (k), and (n) were achieved while the COE program outcomes (a), (c), (h), and (j) were not achieved

Course Outcomes Assessment

Outline

- Course Outcomes Assessment Process
- Course Learning Outcomes Table
- Course Learning Outcomes Evaluation Table
- Course Learning Outcomes Indirect Assessment
- Course Assessment Results Example
- Term 061 Course Outcomes Assessment
- Term 062 Course Outcomes Assessment
- Term 071 Course Outcomes Assessment
- Course Assessment Summary

Course Outcomes Assessment Process

- Each COE course has a Course Learning Outcomes Table that includes the following for each outcome:
  - Outcome indicators and details: this describes the main course topics that will be focused on to achieve the outcome.
  - Suggested assessment methods and metrics.
  - Outcome minimum weight: this indicates the importance of the outcome in the course. It is the minimum weight from the total course score (out of 100) that must be used for assessing the outcome or covering the outcome in the course.
  - A mapping between the course learning outcome and ABET program outcomes.
  - Each outcome is given a rank as Low, High, Medium that correlates with the weight used for assessing the outcome.

Course Outcomes Assessment Process

- Course outcomes are assessed by course instructors both directly and indirectly.
- Suggested direct assessment of course learning outcomes based on using Course Learning Outcomes Evaluation Table includes the following for each outcome:
  - Outcome minimum weight.
  - Outcome weight: this is to be filled by the instructor indicating how much weight was used by the instructor for assessing the outcome.
  - Assessment Method: this describes what methods were used to asses the outcome, the weight of each method, and the evidence of assessment.
  - Class Average: indicates the student's average performance in the outcome.

Course Learning Outcomes Table Example (COE 205)

Course Learning Outcomes	Outcome Indicators and Details	Assessment Methods and Metrics	Min. Weight	ABET 2000 Criteria
1. Ability to analyze, design, implement, and test assembly language programs.	Instruction Set Architecture Number (unsigned and signed) and character representation Addressing modes Syntax, semantics, and effect on flags of Pentium instructions. Input/output. Arithmetic and logic operations. Flow-control structures. Procedures. Macros. String manipulation. Interrupt mechanism. Implementation of Pseudo code algorithms in assembly language.	Assignment Quizzes Exams Project	55%	C(H)

Course Learning Outcomes Table Example (COE 205)

Course Learning Outcomes	Outcome Indicators and Details	Assessment Methods and Metrics	Min. Weight	ABET 2000 Criteria
2. Ability to use tools and skills in analyzing and debugging assembly language programs.	• Assembly language vs. machine language. • Assembling and linking assembly programs (including use of multiple files). • Use of debugger to analyze and debug programs. • Use of libraries.	• Lab work	4%	K(L)
3. Ability to design the datapath and control unit of a simple CPU.	• Fetch-execute cycle • Data, address and control busses • Register transfer • Data path design: 1-bus, 2-bus and 3-bus CPU. • Derivation of control steps for assembly instructions. • Hardwired Control unit design • Microprogrammed control unit design. • Fixed vs. variable instruction format.	• Assignments • Quizzes • Exams	15%	C(M)

Course Learning Outcomes Table Example (COE 205)

• Course Learning Outcomes	• Outcome Indicators and Details	• Assessment Methods and Metrics	• Min. Weight	• ABET 2000 Criteria
• 4. Ability to demonstrate self-learning capability.	• Ability to learn a course topic alone (e.g. Macros) • Course Project may involve topics not studied in the course	• Assignment • Quizzes	• 2%	• I(L)
• 5. Ability to work in a team.	• Project is divided into separate parts that will be integrated for project completion.	• Project	• 2%	• D(L)

Course Learning Outcomes Evaluation Table Example (COE 205)

Outcome	Outcome Min. Weight	Assessment Method								
		Assign.	Quizz	Exam I	Exam II	Exam III	Final Exam	Lab Work	Proj.	Total
O1	55%	15	8	15	20			10		68
	Average	10.9	5.2	10.4	14.4			8.3		49.2 (72.4%)
	Evidence	#1-4	#1-5	Q 1-4	Q1-5			Lab Exp.		
O2	4%							2		2
	Average							1.4		1.4 (70%)
	Evidence							Lab Exp.		
O3	15%						20			20
	Average						13.1			13.1 (65.5%)
	Evidence						Q 1-4			

Course Learning Outcomes Evaluation Table Example (COE 205)

Outcome	Outcome Min. Weight	Assessment Method								
		Assign.	Quizz	Exam I	Exam II	Exam III	Final Exam	Lab Work	Proj.	Total
O4	2%		2							2
	Avg.		1.56							1.56 (78%)
	Eviden.		#6							
O5	2%								8	8
	Avg.								5.8	5.8 (72.5%)
	Eviden.								Rep.	
Weight		15	10	15	20		20	12	8	100
Average		10.9	6.76	10.4	14.4		13.1	9.7	5.8	71.1

Course Learning Outcomes Indirect Assessment Example (COE 205)

Criteria	Student Evaluation					
	E (4)	G (3)	A (2)	P (1)	NA (0)	Composite
1. As a result of this course, my ability to analyze, design, implement, and test assembly language programs can be described as,	9	7	3			3.32
2. As a result of this course, my ability to use tools and skills in analyzing and debugging assembly language programs can be described as,	2	8	8		1	2.53
3. As a result of this course, my ability to design the datapath and control unit of a simple CPU can be described as,	2	9	6	6	1	2.53
4. As a result of this course, my ability to demonstrate self-learning capability can be described as,	6	8	2	3		2.89
5. As a result of this course, my ability to work in a team can be described as,	7	9	2	1		3.16
	Number of Responses: 19					

Course Assessment Results Example (COE 205)

Section#	Source of Outcome Data	Outcome1	Outcome2	Outcome3	Outcome4	Outcome5
I	Instructor Evaluation	64.8%	48.2%	72.3%	62.8%	61.7%
	Student Survey	75%	65%	68.2%	73.3%	75%
II	Instructor Evaluation	77.8%	80.7%	70.1%	75.2%	75.2%
	Student Survey	88.25%	88.25%	69%	75%	86.8%
III	Instructor Evaluation	77.4%	86%	77.5%	78%	78.8%
	Student Survey	87%	79%	77.8%	81.5%	80.3%
Overall	Recommend.	Achieved	Needs Improv.	Needs Improv.	Achieved	Achieved

Course Assessment Results Example (COE 205)

- Observations:
  - Outcome 2 and Outcome 5 have not been assessed directly in Section II and Section III and the lab mark has been used.
  - Based on the overall assessment and instructors feedback, it seems that Outcome 2 and Outcome 3 need improvement. All Other outcomes are considered well-achieved.
- Recommendations:
  - Outcome 2 needs more emphasis in the lab and should be directly assessed by lab instructors.
  - Outcome 3 can be improved by increasing the number of assignments on this part from one to two.

Term 061 Course Outcomes Assessment

	O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11
COE 202	A	NI	NA								
COE 203											
COE 205	A	NI	NI	A	A						
COE 305	A	NI	NI	A	A	A	A				
COE 308	NI	A	NI	NI	A						
COE 341	NI	A	A	NI	A						
COE 344	NA	A	NI	A	A						
COE 360	NI	A	A	NA	NA	NI					
COE 390											
COE 400											

A: Achieved NI: Needs Improvement NA: Not Achieved

Term 062 Course Outcomes Assessment

	O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11
COE 202	A	NI	NI								
COE 203	A	A	NI	A	A						
COE 205	A	A	A	A	A						
COE 305	A	A	A	A	NI	A	NI				
COE 308	A	A	NI	A	A						
COE 341	NI	A	NI	A	A						
COE 344	A	A	A	NI	A						
COE 360	A	A	NI	NI	A	A					
COE 390	A	A	A	A	A						
COE 400	A	A	A	NI	NI	A	A	A			

A: Achieved **NI: Needs Improvement** **NA: Not Achieved**

Term 071 Course Outcomes Assessment

	O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11
COE 202	A	NI	NI								
COE 203	A	A	A	A	A						
COE 205	A	NI	NI	A	A						
COE 305	A	A	A	A	A	A	A				
COE 308	A	A	A	NI	A						
COE 341	NI	A	A	A	A						
COE 344	NA	A	NI	A	A						
COE 360	A	A	NI	A	A	A					
COE 390	A	A	A	A	A						
COE 400	A	A	A	A	NI	A	A	A			

A: Achieved **NI: Needs Improvement** **NA: Not Achieved**

Course Assessment Summary

- While some of the course outcomes were considered not achieved in Term 061, all outcomes in Term 062 were either Achieved or Need Improvement.
- Only one course outcome not achieved in Term 071 (COE 344).
- More outcomes are achieved in Term 062 than Term 061 and more outcomes are achieved in Term 071 than Term 062.
- Results of course assessment over the three semesters indicate corrective action resulting in improving course outcomes achievement.

Indirect Assessment

Outline

- Summary of Industrial Advisory Committee Feedback
- Summary of Exit Survey
- Summary of Alumni Survey

Summary of COE Industrial Advisory Committee (IAC) Feedback

COE Industrial Advisory Committee

- Since 2006, the COE IAC has eight members:
  - Six from the local Industry
  - Two from the COE department
- IAC Goal: Provide feedback to assist the COE Department in achieving its mission and objectives
- First meeting on April 25, 2007
  - Attended by all COE faculty and by students representatives
  - CCSE Dean and chairmen of SE and ICS departments were invited
  - The main issue discussed is how to improve the "Relationship between COE-KFUPM and Industry"

COE IAC Feedback

- The IAC members:
  - Expressed their satisfaction about the BS Program in Computer Engineering
  - Discussed:
    - Partnership with industry
    - Stronger coop and summer training programs
    - Quality of computer engineering graduates

COE IAC Feedback – BS Program

- COE graduates lack wider exposure to High-Performance Computing and Software areas, while COE department has a stronger VLSI area
- Need to concentrate on system design projects, providing more emphasis on system integration using available components
- Need to develop top most quality and capability access to massive data - data storage, retrieval, analysis, management and security

COE IAC Feedback - Lab

- IAC satisfied regarding the lab facilities and experiments conducted
- IAC offered their support for further lab development
- IAC stated that the kind of system applications available in the System Design Lab is exactly what they are looking for future collaboration of COE-KFUPM and Industry

COE IAC Feedback - Quality of Computer Engineering Graduates

- Lack of communication and presentation skills in COE-KFUPM graduates, in general
  - As a result, the industrial requirements are not fulfilled
- Lack of exposure of COE Graduates to current developments in IT that is used in the industry

COE IAC Feedback - COE Department-Industry Interaction

- There is an urgent need to improve COE faculty-industry relations through:
  - Faculty Exposure to Industry:
    - Bringing case studies related to course subjects from local industrial sections
  - Research Interaction with Industry:
    - Strengthening the involvement of faculty in solving local industrial problems
      - May require looking at the rules and regulations for the university faculty to work with local industry

COE IAC Feedback - Effectiveness of Coop and Summer Training Programs

- Work plan should be identified ahead of time for students going to industry/company for coop or summer training program
- Coop students from KFUPM are focusing on mere reporting to the department rather than presenting their learning experience
- Low level of work presentation

IAC Survey

- IAC Survey for seeking the input and assessment of IAC members on:
  - Program Educational Objectives
  - Program Outcomes
  - Program Assessment System
  - Quality of COE-KFUPM Graduates at the workplace, and Abilities, Attributes and Skills
- Five members responded to the survey

IAC Inputs on the Educational Objectives

- The nature of our business is to have engineers with both business and engineering backgrounds
- Good objectives, however, there is a need to focus on few areas to shine in and gain regional and worldwide reputation
- There is breadth but not much depth in the overall objectives
- Provide graduate engineers with the ability to support the industry in the areas of communication network design and embedded system design

IAC Inputs on the Program Outcomes

- KFUPM graduates are very good especially as to work ethics
- Stress more practical disciplines
- COE graduates lack the specialization:
  - They have basic knowledge in designing networks and developing software codes for embedded systems, but have no in depth focus
  - They should go in depth in specific disciplines that will make them productive faster
  - Dedicate at least the last 2 semesters as a minimum are for a specialization
- Need some improvements, since we are now competing at the international level
  - Companies now look for skilled employees regardless of their physical locations

IAC Inputs on the Program Assessment Method

- Reasonable
- Very good

COE IAC Feedback - COE Program Improvement Areas

- The COE program needs to improve the listed below graduate abilities, attributes, and skills which are estimated to be important for the Industry:
  - Function on multi-disciplinary or cross-functional teams (all)
  - Understand the contemporary issues surrounding him (all)
  - Use computing technology in communications (all)
  - Communicate orally: informal and prepared talks (2)
  - Communicate in writing: letters, technical reports, etc. (2)
  - Ability to use state of the art techniques, and tools (2)
  - Design a system, component to meet a desired need (1)
  - Analyze and interpret data from experiments (1)
  - Recognize professional and ethical responsibility (1)
  - Use computing technology in engineering analysis/design (1)

COE IAC Feedback - Most Useful Knowledge, Skills, and Tools Needed Prior to COOP or ST

- Technical writing skills
- Learning how to search the Internet for information
- In depth technical knowledge in practical areas relevant to need of local and multinational companies operating in the region
- KFUPM need to assess the need of the industry and focus more in the area that is more relevant, e.g., HPC is needed locally
- Infrastructure design using Microsoft and Sun environments
- Networking and storage designs
- Troubleshooting skills and analysis
- Programming in C and C++
- Automated Office skills (Word/Excel, etc.)
- Study of industrial standard C51 microcontroller, and the use of the microcontroller development tools such as: compiler, simulator, and in-circuit emulator

COE IAC Feedback - How to Improve the COE Education?

- More interaction with the local industry
- Capitalize on local and related technologies to address country challenges
- Increase the exchange of skills and knowledge between world class universities in related fields
- Introduce the distance learning / video conferencing in the related fields
- More up-to-date dynamic curriculum to reflect the ever changing technology, e.g., web 2.0 programming and HPC
- Enhance the laboratory skills
- Study software quality
- Study embedded systems operation system

COE IAC Feedback - How to Improve the Professional Partnership Between COE and the Industry?

- Professors and educators need to spend time in the industry
  - To match KFUPM programs with the industry requirement
- Conduct knowledge transfer sessions where industry and academia exchange their experience and skills
- Introduce industry challenges to the education sector to address these challenges through senior projects or special studies
- KFUPM needs to visit the companies and survey them to understand where the needs are
  - Based on this, align KFUPM direction and change its strategy
  - At the end, the industry and students are KFUPM end customers
- More frequent visits of students and Faculty to Industry
- Getting advisors from Industry
- Focus on coop programs
- Encourage graduate students to do their projects on topics that have direct impact on the local needs

Summary of COE Graduating Student Survey (Exit Survey)

Exit Survey - COE Program Outcomes (Abilities and Skills)

- The COE graduating students gave high rating (> 80%) to:
  - Ability to apply general principles of mathematics, science, and engineering to analyze and solve computer engineering problems
  - Quality and variety of COE design projects helpful in developing engineering design skills
  - Oral and written communication skills
  - Understanding of the impact of computer engineering solutions in my society and in the world
  - Understanding the contemporary social, political, and technical issues that surround our society
  - Ability to integrate different hardware and software components of a system to come up with a solution to a practical problem or need

Exit Survey - COE Program Outcomes (Abilities and Skills)

- The COE graduating students gave relatively moderate rating (68.8% - 79%) to:
  - Teamwork experience
  - The training and practice in the areas of software design and development
  - Engage in a lifelong learning process
  - Use software and hardware tools needed to solve computer engineering problems

Exit Survey - COE Program Outcomes (Abilities and Skills) – Summary of Improvement Areas

- All course learning outcomes are rated with a good rating with the least rating being 68.8% (3.44/5)
- Teamwork instruction and guidance given to students needs to be improved

Exit Survey - COE Program Educational Objectives

- The COE Graduating students gave high rating (> 80%) to:
  - Practice the profession as a computer engineer with confidence
  - Be globally (worldwide) competitive in the profession
  - Make intellectual contribution to the profession
  - Improve the personal skills (e.g., teamwork, leadership, etc.)
  - Ability and motivation to continuously improve technical skills
  - Training for professionally adapting to changes in the field
  - Background that can be built on to continue higher studies for the MS and PhD degrees

Exit Survey - COE Program Educational Objectives

- The COE Graduating students gave relatively moderate rating (72% - 79%) to:
  - Importance of superior work ethics in the practice of my profession
  - Importance of good character in the practice of my profession

Exit Survey - COE Program Educational Objectives – Summary of Improvement Areas

- All COE Program education objectives are rated with a good rating with the least rating being 72%
- Students' understanding of the importance of good character in the practice of computer engineering profession needs to be improved

Exit Survey - Learning Environment – Improvement Areas

- The following needs improvement (60% - 70%):
  - Quality of instruction in Mathematics, Physics, and Chemistry
  - Quality of Laboratories: Instruction provided by lab instructors, Experiments and lab manuals, Computing facilities and equipments
  - Quality of supervision or advice: Summer training or COOP, Academic planning, Career planning (All students agree on this issue).
  - Equity of treatment by: Teaching assistants and lab instructors
  - Quality of Academic Services: Registration process
  - Quality of the facilities: Food services, Student housing, Parking (All students agree on these issues).

Exit Survey - Students' Comments Summary – Improvement Areas

- Based on students' comments, the following needs improvement:
  - Course Textbooks
  - Labs, lab manuals, and lab instruction
  - Collaborative learning and teamwork

Summary of
COE Alumni Survey

COE Alumni Survey

- The COE Program Educational Objectives Assessment Summary is based on 50 Alumni who were surveyed
- All COE Program education objectives rated with a good rating with the least rating being 66.4% (3.32/5):
  - Practice the profession as a computer engineer with confidence
  - Make intellectual contribution to my profession
  - Technical breadth
  - Technical depth
  - Importance of superior work ethics in the practice of the profession
  - Importance of good character in the practice of the profession
  - Ability and motivation to continuously improve the technical skills
  - Background that can be built on to continue higher studies for the MS and PhD degrees.

COE Alumni Survey – Improvement Areas

- The ones that achieved the lowest rating and need improvement are:
  - Training for professionally adapting to changes in the field
  - Background to be globally (worldwide) competitive in the profession
  - Background to improve the personal skills (e.g., teamwork, leadership, oral and written communication skills, etc.) in the work place

Summary

- The COE department is seeking accreditation from ABET EC 2K as one quality assurance for its BSc program
- The COE department is determined to improve its program both the technical and behavioral components to meet EC 2K
- New instruction techniques for outcome-based education will be gradually introduced at all levels to improve the quality of the Computer Engineer to some international standard.
- The Industrial Advisory Board is one important channel to provide the department with feedback on the achievement of long term educational objectives as experienced by our COE alumni