Instructional Program/ Discipline Review
Engineering Department 2006-07
5/20/2007

COVER PAGE

Program/Discipline:_____Engineering Program__________________________________

TOPS Code:____

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1. Program Description and Scope

Provide a brief narrative that describes the instructional program.

The Engineering Department at Ohlone College under the Math, Science and Engineering Division offers lower-division engineering or pre-engineering program that allows students to complete their upper-division engineering requirements for a baccalaureate degree program in engineering disciplines such as Industrial, Mechanical, Electrical, Civil, Chemical, Aeronautical, Computer engineering, etc. Ohlone College also offers an Associate of Science (A.S.) degree in engineering.

Describe how the program specifically serves students, faculty, staff, and/or the community.

Both the transfer and the A.S. program provide higher level math and physics, foundation engineering courses, and allow a smooth transition to many of the engineering majors at schools such as San Jose State University, Cal Poly, San Luis Obispo, and UC Berkeley, Davis, etc.

Describe how the program addresses current needs and applies current technologies.

The math and engineering faculty stay in contact with engineering graduates so that the needs of current students can be continually assessed. Recent feedback from former students indicated that MATLAB is used extensively at their 4-year colleges. If the course was offered at Ohlone College, these students would take it. As a result, a 3-unit MATLAB course is being developed for engineering students and will be offered for the first time in summer 2007.

In addition, major changes have been made to the Introduction to Engineering course to introduce students to working on projects in teams. This is following a move at many 2 and 4 year colleges and universities across the country to help retain and better prepare engineering students for future success.

Discuss the impact of the program on the college and the impact the college and/or other college programs have on the program being reviewed.

Although the Engineering Department is small by itself, most of the higher level math classes as well as physics and possibly chemistry are taken by engineering students. If the engineering program were to disappear, these other departments may be greatly impacted as students would most likely take these courses with their engineering classes <u>at other schools.</u>

Discuss the impact of the program on the community and the impact of the community on the program.

Ohlone College is a part of the Ohlone Community College District with campuses in Fremont and Newark, as well as the virtual campus of online course offerings. In 2005-2006, the District served six high schools, two continuation high schools, two adult schools, and the Regional Occupational Program, and more than 12,000 students. Ohlone is proud of its role in the community college system - both in the United States and California - and honored to be able to provide its students with a quality educational experience.

2. Relationship to Ohlone College Mission and Goals

The Engineering Department supports two of the eight Ohlone College Goals: 2 and 3.

Goal 2:
Develop across the curriculum the Learning College Model, utilizing methods and technologies that hold the most promise for improving student course and program completion success rates

The following topics are discussed in section 5, Assessment of Program through Review of the Teaching Learning Process.

- Hands-on activities
- Design projects
- Laboratory exercises
- Active learning methods (brainstorming, teambuilding)

Goal 3:
Develop strategies to increase the proportion of fulltime students including learning communities, enhanced facilities and improved course availability

The following topics are discussed in section 5, Assessment of Program through Review of the Teaching Learning Process.

- Enhance lab facilities
- Retention of engineering faculty
- Improve course availability
- Recruitment and retention of women
- Expand existing laboratory courses to include hands-on exercises

3. Program Student Learning Outcomes

3.1 Development of Student Learning Outcomes

A Student Learning Outcome (SLO) is a global and broad measurement statement that clearly states the knowledge, skills, abilities and attitudes a student should have attained upon completion of a course or program. Learning outcomes:

- Focus on what the student can do
- Demonstrate that the student is competent
- Include a measurable expectation
- Use active verbs (Bloom's Taxonomy)

The engineering team met and decided that there are two skill sets that students need to be focused on when preparing for transfer:

- "Hard" skills – technical coursework needed to transition seamlessly to a 4-year college or university program
- "Soft" skills – teambuilding, communication - needed for the 21st century engineer

The team decided that the best place to start the process of developing SLOs would be to look at the Engineering Accreditation Commission (ABET) website (http://www.abet.org/). This website has standards for Engineering 4-year accredited programs. Since students transferring have the equivalent of two years of a four-year program, it is reasonable that for the transfer program to provide a seamless transition, the transfer SLOs should be a subset of the ABET guidelines. Thus, applicable SLOs have been selected from the list of 11 ABET SLOs, and then modified to meet the needs of an entering transfer student.

[To find the ABET SLOs: On the ABET page, click the "Quick Link" for Criteria for "Accredited Programs". Under "Download Forms and Criteria", select "Engineering Programs only". Click this and select "2006-2007 criteria". The document will be named "Criteria for Accrediting Engineering Programs". The 11 student learning outcomes are on page 4.]

A large number of documents have been written on the soft-skill needs of the 21st century engineer: papers issued by the American Association of Engineering Education, discussions at Engineering Liaison Council web articles on freshman engineering programs at other 2 and 4 year colleges, news articles, books such as "The World is Flat" by Thomas L. Friedman, etc.

3.2 Engineering Student Learning Outcomes

At the end of their engineering program, students will:

SLO1. Employ general principles, theories, concepts and/or formulas in the solution of problems.

For a particular problem, students will demonstrate that they can:

1. **Define and describe the pertinent principle, theory, concept and/or formula**
2. **Explain why it is appropriate to the problem**
3. **Demonstrate how it has been applied in the solution of the problem**

[This SLO is a subset of ABET criterion for 4-year programs (a) Engineering programs must demonstrate that their graduates have an ability to apply knowledge of mathematics, science, and engineering.].

For ABET SLO location, see reference in 3.1

SLO2 Conduct an experimental procedure, use laboratory materials properly and safely, carefully note observations, and describe the procedure clearly for others.

[This SLO is a subset of ABET criterion for 4-year programs (b) Engineering programs must demonstrate that their graduates have an ability to design and conduct experiments.]

For ABET SLO location, see reference in 3.1

SLO3 Demonstrate an understanding of the engineering design process.
For a particular design project, students will demonstrate that they can:

1. **Define the problem**
2. **Gather information (literature search)**
3. **Generate multiple solutions**
4. **Analyze and select a solution**
5. **Implement the solution**
6. **Evaluate the solution**
7. **Document the results**

[This SLO is a subset of ABET criterion for 4-year programs (c) Engineering programs must demonstrate that their graduates have an ability to design a system, component, or process to meet desired needs.]

For ABET SLO location, see reference in 3.1

SLO4 Participate effectively as team members in group projects

For a particular project, students will demonstrate that they can:

1. **Define team rules, policies and a team contract**
2. **Learn techniques for developing effective teams**
3. **Evaluate individual team members with peer reviews**

[This SLO is a subset of ABET criterion for 4-year programs (d) Engineering programs must demonstrate that their graduates have an ability to function on multidisciplinary teams.]

For ABET SLO location, see reference in 3.1

SLO5 Demonstrate that they have the ability to use computer-aided drafting

[This SLO is a subset of ABET criterion for 4-year programs (k) Engineering programs must demonstrate that their graduates have an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.]

For ABET SLO location, see reference in 3.1

3.3 Allocation of Student Learning Outcomes

The following rubric shows how the student learning outcomes are allocated across the engineering courses.

<u>Engineering Department Course Offerings</u>

ENGI-101	Introduction to Engineering
ENGI-102*	Women in Science and Technology (recruiting course)
ENGI-115	Engineering Communication
ENGI-120	Engineering Mechanics (Statics)
ENGI-130	Electric Circuit Analysis
ENGI-131D*	Review of Engineering Concepts
ENGI-140	Materials Engineering
ENGI-190*	Scientific Research Methodology

* Not active at this time

	ENGI 101	ENGI 102 *	ENGI 115	ENGI 120	ENGI 130	ENGI 131D *	ENGI 140	ENGI 190 *
SLO 1				X	X		X	
SLO 2					X		X	
SLO 3	X							
SLO 4	X							
SLO 5			X					

Assessment Matrix

Student Learning Outcome	**Learning Outcomes**	**Strategies for Implementing Outcome**	**Assessment Methods**
SLO 1	Employ general principles, theories, concepts and/or formulas in the solution of problems	General engineering principles, theories, concepts and/or formulas will be introduced in Engineering Mechanics (Statics), Electric Circuits and Materials Engineering. Focus will be on the identification and application to solving problems.	Rubric
SLO 2	Conduct an experimental procedure, use laboratory materials properly and safely, carefully note observations in a laboratory notebook, and describe the procedure clearly for others	Students will perform laboratory assignments in Electric Circuits and Materials Engineering	Analysis Rubrics
SLO 3	Demonstrate an understanding of the engineering design process	Students will complete a design project in Introduction to Engineering, present results, write design report and keep an Engineer's Logbook	In-class presentation Design report Engineer's Logbook
SLO 4	Participate effectively as team members in group projects.	Students will participate in teams on projects in Introduction to Engineering	Peer reviews
SLO 5	Demonstrate the ability to use modern engineering tools necessary for engineering practice	Students will complete a design project in Engineering Communication	Portfolio of student's work

3.4 Measurement and Assessment of Student Learning Outcomes

SLO1. Employ general principles, theories, concepts and/or formulas in the solution of problems.

For a particular problem, students will demonstrate that they can:

1. **Define and describe the pertinent principle, theory, concept and/or formula**
2. **Explain why it is appropriate to the problem**
3. **Demonstrate how it has been applied in the solution of the problem**

This SLO will be assessed in the following courses: Engineering Statics, Electric Circuits and Materials Engineering.

Method of Assessment

The instructor in each of the above disciplines will ask students to solve a problem which will employ general principles, theories, concepts or formulas specific to that course. It could be one or two problems in a homework assignment or in a test. It is important that the student use each of the three steps in solving the problem. The instructor will collect a sample of these assignments and evaluate them using the following rubric. The results will be collected each time the course is offered. A small faculty committee designated by the Program Review committee will then evaluate the work for the next formal assessment.

Assessment Rubric for SLO1

Steps for SLO1	4	3	2	1
Define the appropriate principle, theory, concept and/or formula	Excellent recall of previously learned knowledge. Selects most appropriate strategy to solve problem.	Good recall. Selects appropriate strategy.	Some recall. A strategy is selected, but it may not be appropriate.	Poor recall. An inappropriate or no strategy is selected.
Describe the appropriate principle, theory, concept and/or formula	Has an excellent grasp of the material and explains it clearly and concisely	Understands the material and able to explain it.	Has some understanding of the material but its meaning is not very clear.	Has no understanding as to how to solve the problem.
Explain why it is appropriate to the problem	Excellent ability to relate the material to the current problem	Can relate the material adequately to get a solution to the problem.	Not quite sure how to relate material to the problem.	Unable to connect any material to the problem.
Describe how it is applied in the solution of the problem	Illustrates excellent ability to use previously learned information. All material is clearly and accurately detailed	Good understanding of how to use the pertinent information to solve the problem	Sketchy explanation. Not sure how to use the materials	Little or no understanding as to how to use learned information

SLO2 Students will conduct an experimental procedure, use laboratory materials properly and safely, carefully note observations, and describe the procedures clearly for others.

We will assess this SLO in the following courses: Electric Circuits and Materials Engineering.

Methods of assessment:

In Materials Engineering, a formal lab report will be assigned and graded using a rubric.

In Electric Circuits, students will build circuits described in a drawing, perform measurements, compare what they calculated based on the theory they learned and also compare with computer simulation results.

Materials Engineering Formal Lab Report

Presentation	Typed and bound with a single staple. Cover sheet: include title of lab, name, lab partner, and date submitted. Body of report must include 6 sections: Objectives, Experimental Procedures, Experimental Results, Discussion, Conclusion, and References. Grade includes grammar, spelling, formatting, references, etc.	10%
Objectives	Single very concise paragraph. States objectives of current laboratory exercise. No more than 5 typed lines at 12pt font.	5%
Experimental Procedures	Description of what you did in lab. May include illustrations if needed to clarify experimental procedures. It is required that the description include details as to what polishing paper was used, temperatures, etc. It should be possible to recreate the lab from your procedures, and the equipment manuals.	5%
Experimental Results	Contains a clinical report of all results referring to all data sheets, spreadsheets, plots, micrographs, calculations and the like by name, such as “Figure 1 shows. . .” Section should be as long as needed to cover all results. Be sure to label all items clearly, including both axes of any data plots, magnification of all images, and captions for all figures.	10%
Discussion	Re-type and answer all questions from lab handouts. Additional commentary is welcome, such as explanations of anomalous results, or unexpected surprises. Always use data to support answers when possible. If your data contradicts expected results, explain why.	60%
Conclusion	List all relevant conclusions as a result of the given experiments.	10%
References	Include outside references used to complete analysis and interpretation of data.	
Appendices	Include all optional supporting materials here, as needed.	

SLO4 Demonstrate an understanding of the engineering design process.

For a particular project, students will demonstrate that they can:

1. **Define the problem**
2. **Gather information (literature search)**
3. **Generate multiple solutions**
4. **Analyze and select a solution**
5. **Implement the solution**
6. **Evaluate the solution**
7. **Document the results (see note)**

<u>Method of Assessment</u>
Deliverables are an in-class presentation, design report and Engineer's Logbook.

NOTE: As part of the documentation, student must contact the Professional Society for the specific engineering discipline to get guidelines as to how the paper should be written for that area

This SLO will be evaluated in the Introduction to Engineering course.

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Assessment Rubric for Design Project
Content, Presentation and Documentation

Attribute	Exceeds Expectations	Meets Expectations	Below Expectations	Not Acceptable	Multiply by	Score
	6 points	5 points	4 points	3 points		
Objective		Precise description	Too generic	Missing	1	____
Requirements	Style and wording make requirements clear	Complete, consistent and unambiguous	Not written for technical audience	Unclear, ambiguous, or not testable	1	____
References and standards	Quality of references show superior insight	All appropriate references and standards listed	References not specific	Some references not cited or standards omitted	1	____
Design constraints	Style and writing make requirements clear	Complete, consistent and unambiguous	Not written for technical audience	Unclear, ambiguous, or not testable	1	____
Alternate solutions	Solutions very clearly described	At least two viable solutions	Poor design	None	4	____
Design selection	Proof presented to validate tradeoff	Logical reasoning used to make tradeoff	Reason for choice not clear	Missing	4	____
Presentation	Interesting and exciting presentation	Described all important features of project	Too short or too long	Unclear	3	____
Demonstration	Went way beyond what was required	Demonstrated all features required	Some parts were not working	Did not work successfully	1	____
Documentation (note above)	Excellent organization, appearance	All documents included	Poorly organized.	Elements missing	2	____

Assessment Rubric for Engineer's Logbook

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Task	Percentage
Project Descriptions	5
Research • Source • URLs	5
A summary of the information obtained and an explanation/evaluation of how it relates to your project	10
Your thought process on each part of the project • All work • What you did • What results you obtained • Projected next steps • Equations • Calculations • Drawings • Block diagrams • Explanatory Text • Contemporaneous meeting notes (regular meetings, design reviews, etc)	50
Total points	70

Guideline	Percentage
Includes a chronological record of your work	5
Written so that someone else ("skilled in the art") can follow your design work and verify it with minimum effort	5
Contains a detailed record of every part of your design process	5
Format should be neat, readable, durable, and orderly	5
Maintained in a bound notebook (not loose leaf, 3-ring binder) with each page numbered and dated . Acceptable (and recommended) to paste-in printouts, web pages, other documents	5
Use ink only. A single line crossing out errors will keep things neat. Do not leave blank pages; make diagonal lines through otherwise blank pages. Start a new date on a fresh page, drawing a diagonal line through unused space on the prior page.	5
Total points	30

SLO4 Participate effectively as team members in group projects

For a particular project, students will demonstrate that they can:

1. **Define team rules, policies and a team contract**
2. **Use techniques for developing effective teams**
3. **Evaluate individual team members with peer reviews**

This SLO will be assessed in the following course: Introduction to Engineering

Evidence of assessment: Peer ratings
Assessment of this SLO uses techniques outlined in a paper appearing in the Journal of Student Centered Learning titled "Turning Student Groups Into Effective Teams". "The paper is self-described as a "*guide to the effective design and management of team assignments in a college classroom where little class time is available for instruction on teaming skills. Topics discussed include forming teams, helping them become effective, and using peer ratings to adjust team grades for individual performance*".

Method of Assessment.
During the first week of class, the instructor will distribute the "Getting to Know You" form. The instructor will then use this information to break the class into teams of four, including (whenever possible) a more mature student in each group.

Each group will use the "Team Policies" and "Student Expectations Assignment" forms to define their rules, procedures and team contract. An article on how to deal with dysfunctional teams will be distributed and discussed. ("Coping with Hitchhikers and Couch Potatoes on Teams"). Teams will be encouraged to discuss problem areas among themselves as early as posssible, and see the instructor if resolution cannot be reached. Instructors will guide the team to work through the issue, not solve it for them. It is imperative that team members learn skills that will be used frequently in the real world.

Approximately half-way through the semester, the instructor will distribute "Evaluation of Progress Toward Effective Team Functioning". Students will use this exercise to identify any additional teams problems that are occurring. Twice during the semester (in the middle and at the end) each team member will complete a "Peer Rating of Team Members" in which he/she will evaluate each team member including him/herself.

SLO5 Demonstrate that they have the ability to use computer-aided drafting

This SLO will be assessed in the following course: Engineering Communications

Method of assessment:
Samples from students' work that demonstrates their ability to use computer-assisted design tools such as a drafting package

This Student Learning Outcome will not be assessed at this time due to time constraints. Data will be gathered for the next Program Review Cycle.

4. Assessment of Student Success in Reaching Program Outcomes

4.1 Assessment Results

The Review and Dissemination Team decided to gather as much baseline data as possible this semester on as many Student Learning Outcomes as time permitted. This section will elaborate on what we were able to accomplish and our findings at this point.

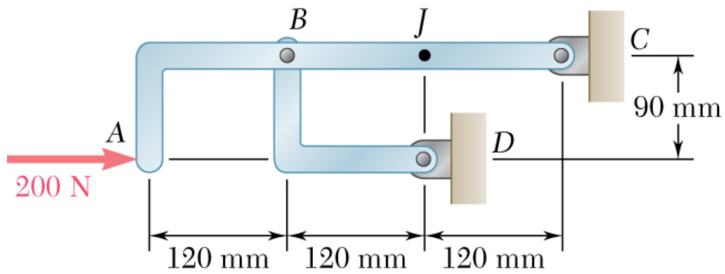
4.1.1 Assessment Results for Student Learning Outcome 1

Student Learning Outcome 1 (SLO1) assesses student's ability to employ general principles, theories, concepts, and / or formulas in the solution of problems. To satisfy SLO1 in Engineering Statics, students were asked to solve the following problem involving forces internal to a frame:

For the frame and loading shown:

a. Determine the axial force (*F*), shear force (*V*) and bending moment (*M*) at point *J*.
b. What is the name of the type of diagram you used to analyze this problem?
c. What is the name of the formulas you used to analyze this problem?
d. Why are these formulas appropriate to this problem?

Engineering Statics Problem



This problem was chosen because it consolidates many of the principles of statics. To successfully complete the problem, students must:

- Draw a free body diagram of member *ABC*, with the correct representation of the forces due to pin connections at points *A* and *B*.
- Generate the appropriate equations of equilibrium for member *ABC*.
- Recognize that member *BD* is a two force member and use this information to calculate the force in member *BD*, and, in turn, forces acting at points *B* and *C*.
- Understand that member *ABC* can be sectioned at point *J*, and that section *JC* is in equilibrium with an internal axial force, shear force and bending moment at point *J*.
- Draw a free body diagram and establish the equations of equilibrium of section *JC* to determine the internal forces and bending moment.

To supplement these objectives, the problem also asks students to specifically identify the name of the diagram used to analyze this problem (free body diagram), the formulas used (equations of equilibrium), and state why these formulas are appropriate to this problem.

All sixteen students taking Engineering Statics completed this problem in the third midterm test of the semester. The following table shows the assessment results as specified by the table “Assessment Rubric for SLO1.”

SLO1 Results Summary for Engineering Statics

Steps for SLO1	Student responses in Category 4	Student responses in Category 3	Student responses in Category 2	Student responses in Category 1
Define the appropriate principle, theory, concept and/or formula	14	2	0	0
Describe the appropriate principle, theory, concept and/or formula	11	5	0	0
Explain why it is appropriate to the problem	13	3	0	0
Describe how it is applied in the solution of the problem	10	6	0	0

The results indicate that students have a good understanding of the fundamental principles of statics, and how to implement these principles in solving problems. All students understand the use of free body diagrams, equations of equilibrium, and the relation between them. In response to part d of the problem, students generally understand that the structure has no unbalanced forces and is in static equilibrium, and hence the equations of equilibrium are applicable. About two-thirds of the students obtain the entirely correct solution, and the other third understand the theory and approach but made one or more arithmetic errors. This suggests that an area for improvement for the class is to more fully encourage students to use redundant equilibrium equations to check their solution. This is a typical practice in engineering, and the students would be well-served by practicing this technique.

4.1.2 Assessment Results for Student Learning Outcome 2

SLO2 Students will conduct an experimental procedure, use laboratory materials properly and safely, and describe the procedure for others.

4.1.2.1 Materials Engineering

A materials laboratory exercise titled the Heat Treatment of Steel was assigned and a formal lab report was required. The purpose of this lab is to study and observe the effects of heat treated steel, to study and experimentally confirm the hardness and the microscopic structure of the steel samples after different cooling processes. Through the lab, students can better study the TTT graphs and actually see the effect the time variable has on the samples of steel.

	%	Group 1	Group 2	Group 3	Group 4
Presentation	10	5	5	5	5
Objectives	5	5	5	5	5
Experimental Procedures	5	5	3	3	4
Experimental Results	10	8	9	6	8
Discussion	60	55	55	56	55
Conclusion	10	6	5	3	5
References					
Appendices					
Total Grade		84	82	83	82

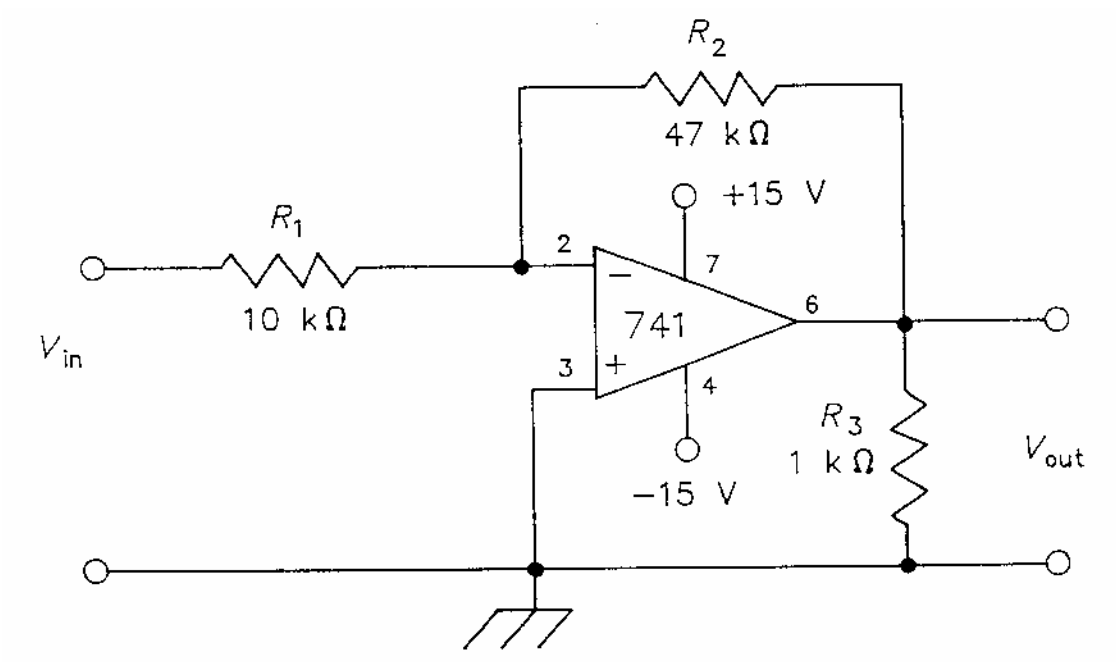
The results show that the students in this class are competent in conducting a materials engineering laboratory experiment safely and documenting the reults in a formal laboratory report. This will be a valuable tool in assessing students' progress in the future.

4.1.2.2 Electric Circuits

In this Electric Circuits laboratory exercise, students were to build circuit in the drawing and then measure output voltage. They then compared what they calculated based on the theory they learned and they also compared their results with computer simulation results.

Electric Circits Laboratory Assignment

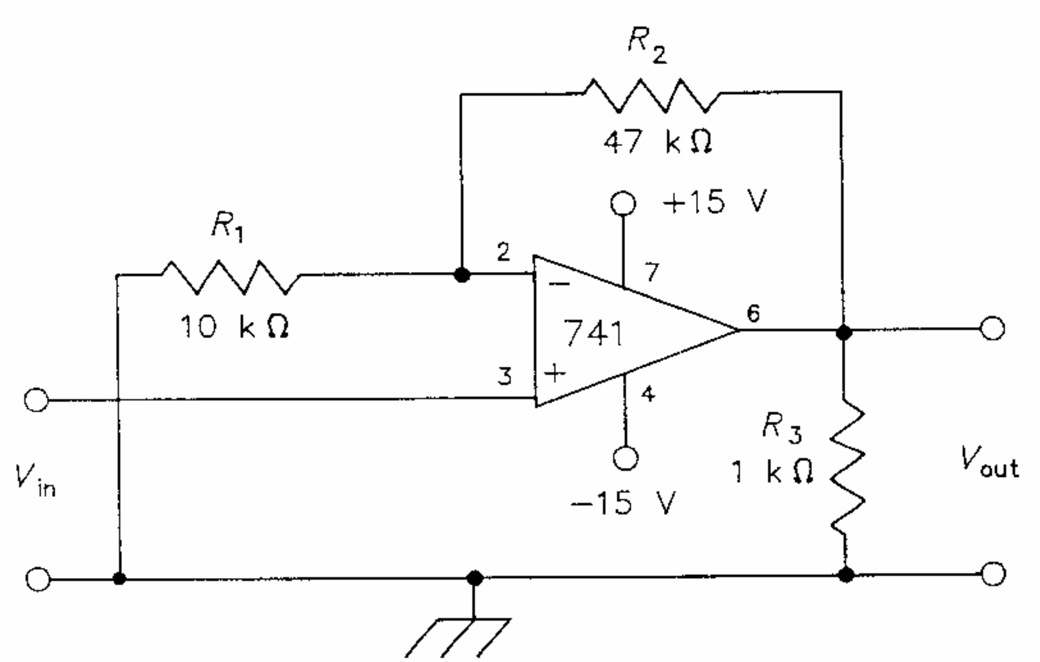
- <u>OP-AMP Lab #1</u>
  <u>Inverting OP-AMP</u>:



PARTS
741 OP AMP
1k
10 k
47 k
100 k

Find Vo when Vin = 1V, 2V, 3V

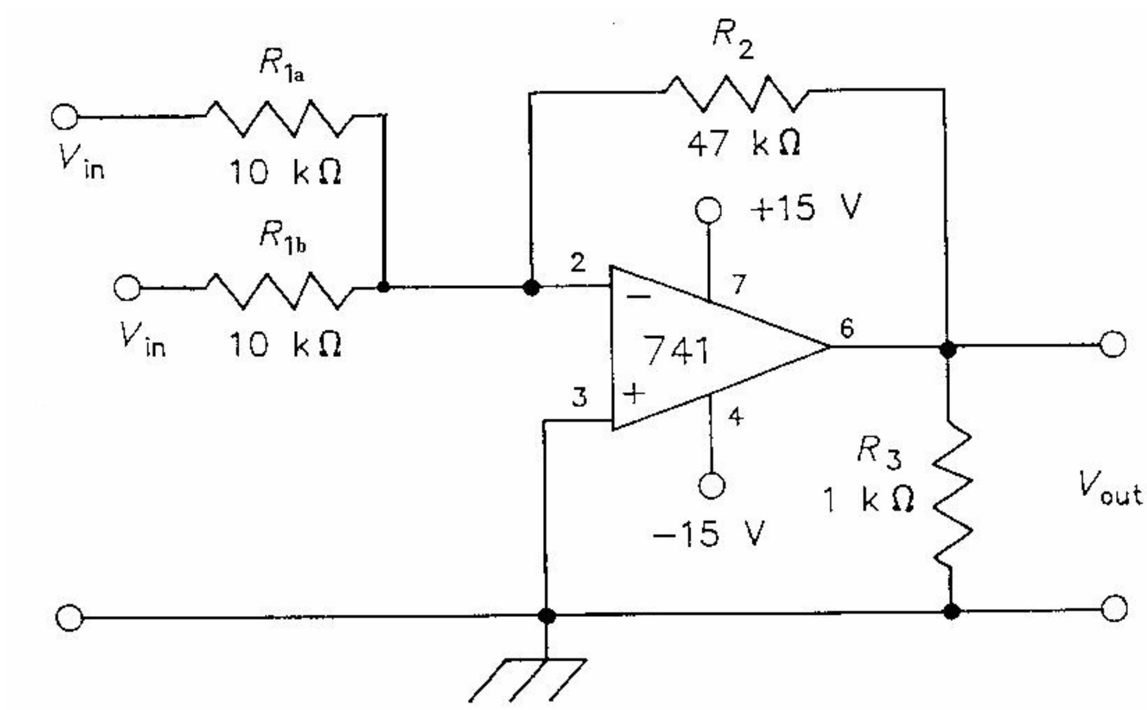
OP-AMP Lab #2
Non-Inverting OP-AMP



PARTS
741 OP AMP
1k
10 k
47 k
100 k

Find Vo when Vin = 1V, 2V, 3V

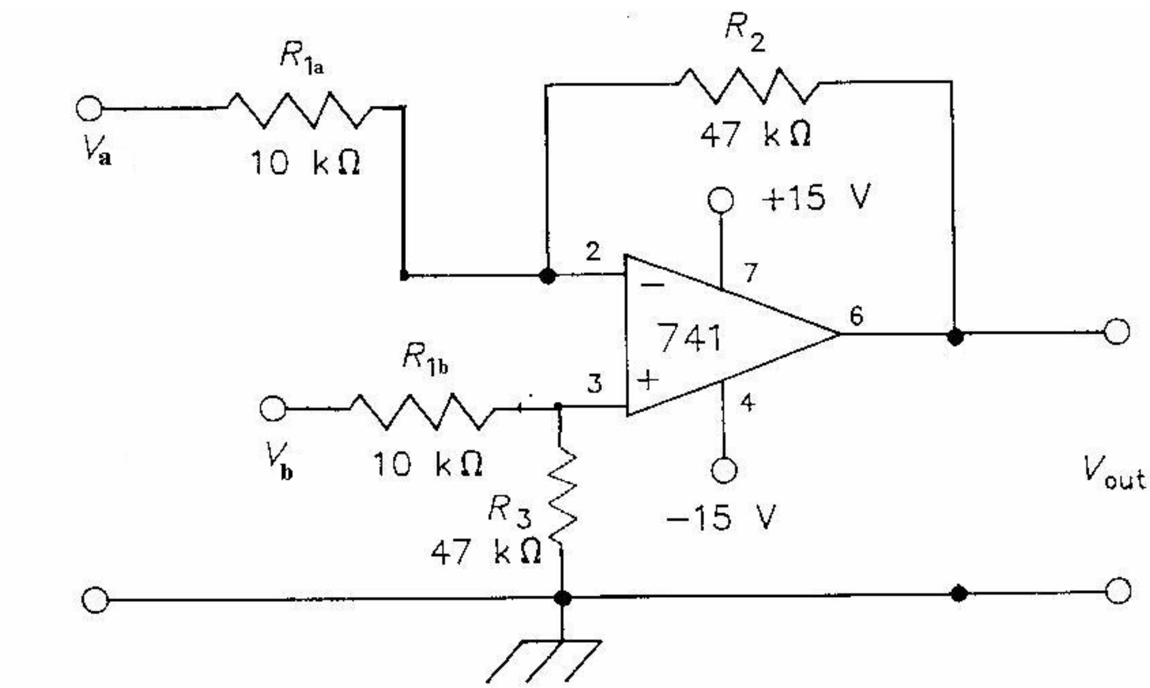
OP-AMP Lab #3
Summing Amplifier



R_{1a} = 10 KΩ
R_{1b} = 10 KΩ
R_2 = 47KΩ
V_{in} = 1V

What is Vo?

OP-AMP Lab #4
Difference Amplifier



R_{1a} = 10 KΩ
R_{1b} = 10 KΩ
R_2 = 47KΩ
R_3= 47KΩ
V_a = 1V
V_b= 1.5V

What is Vo? What is Vo if V_a = 1V and V_b = 2V

<u>Results</u>
The instructor indicated that all the students were able to complete this lab exercise sucessfully. This will be an excellent tool for assessment in the future.

4.1.3 Assessment Results for Student Learning Outcome 3

SLO3 Students will conduct an experimental procedure, use laboratory materials properly and safely, and describe the procedure for others.

The class was broken up into 3-4 student teams and given the following Freshman Engineering Design Project developed by Dr. Charles L. Karr at the University of Alabama.:

"Your team is being hired by the owner of a paved, 100 ft by 200 ft corner parking lot in a New England town who needs her parking lot designed. Your job is to design the layout of the parking lot, or rather, how the lines will be painted. Three handicapped spaces and allowance for panel truck deliveries are to be provided. Although no final decision has been made, the company most likely will be either a plumbing supply business or a specialty shop for lampshades."

<u>Results of Assessment</u>
Students did very well in understanding the objectives and requirements, doing the research, coming up with other alternatives and then choosing a design. The handout on the next page was given to the students to help them know what and how to research this problem. Their presentations were fairly good. However, their logbooks were incomplete, so there will have to be more focus in this area. Part of the problem had to do with how teams divided up the work and coordinated it (a vital component in project work!)

Overall, the students did quite well on this project. Understanding the engineering design process and applying it to engineering projects will be a very useful skill for them to know in transferring to upper-division engineering programs.

Parking Lot Design - Things to Research

1. Type of business
   How much traffic will there be?
   Will most of the parking be all-day or in-and-out?
   Will there be peak times?
   Will shopping interefer with rush hour traffic?
   Traffic patterns in parking lot?

2. Size of stalls
   What is the size of car stalls?
      Vans?
      Compacts?
      Regular cars? Panel trucks?
      Handicapped parking? Van accessible?
   Are compacts grouped together?
   What percentage are compacts?
   Where is the place for truck unloading?
   How much space should be allowed?

3. Parking angles
   What are the standard parking angles for parking lots?
   What are pros/cons of different angles?
   How much swing angle to get in and out?
   How wide the access lane?
   What is the traffic flow?
   How many cars?
   What's best for this kind of parking lot use?

4. Entry/exit
   How wide?
   One car/two car?

5. Pedestrian walking

6. Should space for shopping carts be allowed?

4.1.4 Assessment of Student Learning Outcome 4

SLO4 Participate effectively as team members in group projects

For a particular project, students will demonstrate that they can:

1. **Define team rules, policies and a team contract**
2. **Learn techniques for developing effective teams**
3. **Evaluate individual team members with peer reviews**

The student teams were assessed during the Parking Lot Design Project. The teams were not formed until a few weeks into the semester, after the initial adding and dropping period was over. After this period, the instructor decided NOT to drop any students until the project was over. It was important for the teams to see how teams work (or not work) through issues like lateness, poor attendance, being there but doing nothing, etc. – especially when everyone seems so enthusiastic at the beginning.

The teams were then broken into 3-4 member groups, trying to balance teams according to maturity, experience, major, years of college, etc. There were 8 teams in all. The students decided on team rules and signed team contracts. Some groups came together very quickly, and it showed in their attendance, their enthusiasm, and their final results. Other teams were not so fortunate. Some students, upon learning that they were to be graded by their peers, thus they would have to work, decided to stop coming. Others would do their share of the work, but then not come for the other portions. They turned in Peer Ratings towards the end, and then after the final presentations. Sample comments from a few of the teams are included on the next few pages.

Sample Comments from Peer Rating of Team Members

Team 1 – Member A

Team Member	**Rating**	**Comments**
A (self)	Very good	Did my work. Participated and contributed.
B	Ordinary	Did most of his work, constantly saying how bored he was and how he wanted to go home.
C	Superficial	Never said anything, basically sat and watched while we did the work
D	Very good	Did his work. Gave useful help and ideas.

Team 1 – Member B

Team Member	**Rating**	**Comments**
A	Very good	Did very well in carrying a task. However, need to listen to other's opinion.
B (self)	Very good	I did well, including the whole presentation.
		Never said anything, basically sat and watched while we did the work
C	Marginal	Barely spoke and gave bad ideas.
D	Very good	Did well with the task. Just need to speak up during presentation.

Team 1 – Member C

Wasn't even there to fill out his comments, but insisted that he did his work and showed up most of the time - after the project was over and he was dropped from the course.

Team 1 – Member D

Team Member	**Rating**	**Comments**
A	Excellent	Worked on Powerpoint and AutoCAD. Worked very hard on the assignment
B	Very good	Worked on engineering logbook and also worked very hard on the assignment
C	Superficial	Usually doesn't show up and when he shows up doesn't say anything
D (self)	No rating	Worked on layout design and checked the engineering logbook

Sample Comments from Peer Rating of Team Members

Team 2 – Member A

Team Member	Rating	Comments
A (self)	Excellent	I did the logbook.
B	Very good	Did the report.
C	No show	
D	Excellent	Excellent work ethic. Did his share of work. Did PowerPoint.

Team 2 – Member B

Team Member	Rating	Comments
A	Excellent	Member A and B did a lot, and I helped also.
B (self)	Satisfactory	
C	No show	
D	Excellent	

Team 1 – Member C

No show – was dropped from the course

Team 2 – Member D

Team Member	Rating	Comments
A	Ordinary	I did the parking lot design and PowerPoint. If member A and C do the thing they're supposed to do (logbook and report), then the group is OK. People showed up or informed so that was OK.
B	Marginal	
C	No show	
D (self)	Excellent	

Instructional Program/ Discipline Review
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5/20/2007
Sample Comments from Peer Rating of Team Members

Team 3 – Member A

Team Member	**Rating**	**Comments**
A (self) B C	Very good Very good Very good	I did what I was supposed to do and I came up with the final design. Members B and C were always early and always ready to do what they were supposed to do.

Team 3 – Member B

Team Member	**Rating**	**Comments**
A	Excellent	Excellent digital representation skill. Willing to do inputs.
B (self)	Very good	Need to improve on digital imagery skill. Great leadership. Pulled the team together.
C	Excellent	Hard worker, always seek for more ideas outside of meeting time.Relaible and great PowerPoint skill.

Team 3 – Member C

Team Member	**Rating**	**Comments**
A B C (self)	Excellent Excellent Very good	Our team did a good job on parking lot design. We separated our job to team members. Member A worked on AutoCAD. Members B and C did research and made blue print for parking lot. It is really true team work.

Results of Assessment and Areas for Improvement

The ability to work in teams is crucial in any area of life – be it personal or professional. The students on this project gained an understanding of the kinds of problems that can come up in teamwork. The teams that happened to have dedicated members had very satisfying experiences. The ones that didn't often had someone who sat around quiet, frustrated, or didn't show up. But regardless of the problems, <u>every team</u> came up with a presentation and a design. The ones that were there realized that they had to perform and they got the job done. I think it was a valuable learning lesson for all. The students that were graded as unsatisfactory by the group were subsequently dropped from the course right after the presentations were completed.

Although this will be very time-consuming, it is important that more research be done on how to help students deal with some of the issues that can develop in teams. There is much literature on the web that should be sifted through and experimented with to see what works. Perhaps setting up 10-minute clinics with each of the teams to see what is working well and what isn't would be useful. Another possibility is to allow teams to "fire" nonparticipating members. To stay in the class, the member would have to find another team to work on.

The next time this course is offered, teams will be formed immediately so that they have more time to "gel". Also, students will be dropped immediately after they exceed the required number of absences. In other words, they will be "fired", just like they would on any job. Teams will recover, and won't be held back by others. If need be, the teams will be realigned.

This is an excellent skill for students to know and it is important that it be introduced into the engineering curriculum as soon as possible so that students can work together more effectively as teams in laboratory experiments, other course projects, etc. This will help students immensely in the long run and is worth the effort now at the community college level. It is vital that the faculty teach the most effective ways to empower our students.

4.2 Trends

- Analyze changes in data, identify trends and provide possible contextual explanations for these changes.

Figure 1 shows annual engineering enrollments dropping for the last three years. At the end of 2003, Professor Keith Level was hired to replace retiring Jim Eagan. However, during the spring semester of 2004, difficult times fell on Ohlone College. There were severe budget cuts by the state, and layoffs occurred at all levels. The Electronics Department was closed; the Engineering Department just barely survived, mainly due to strong support from students and faculty members. Professor Gary Mishra moved over to Engineering and replaced Keith Level. In addition to all this turmoil, tuition rates were increased by the state.

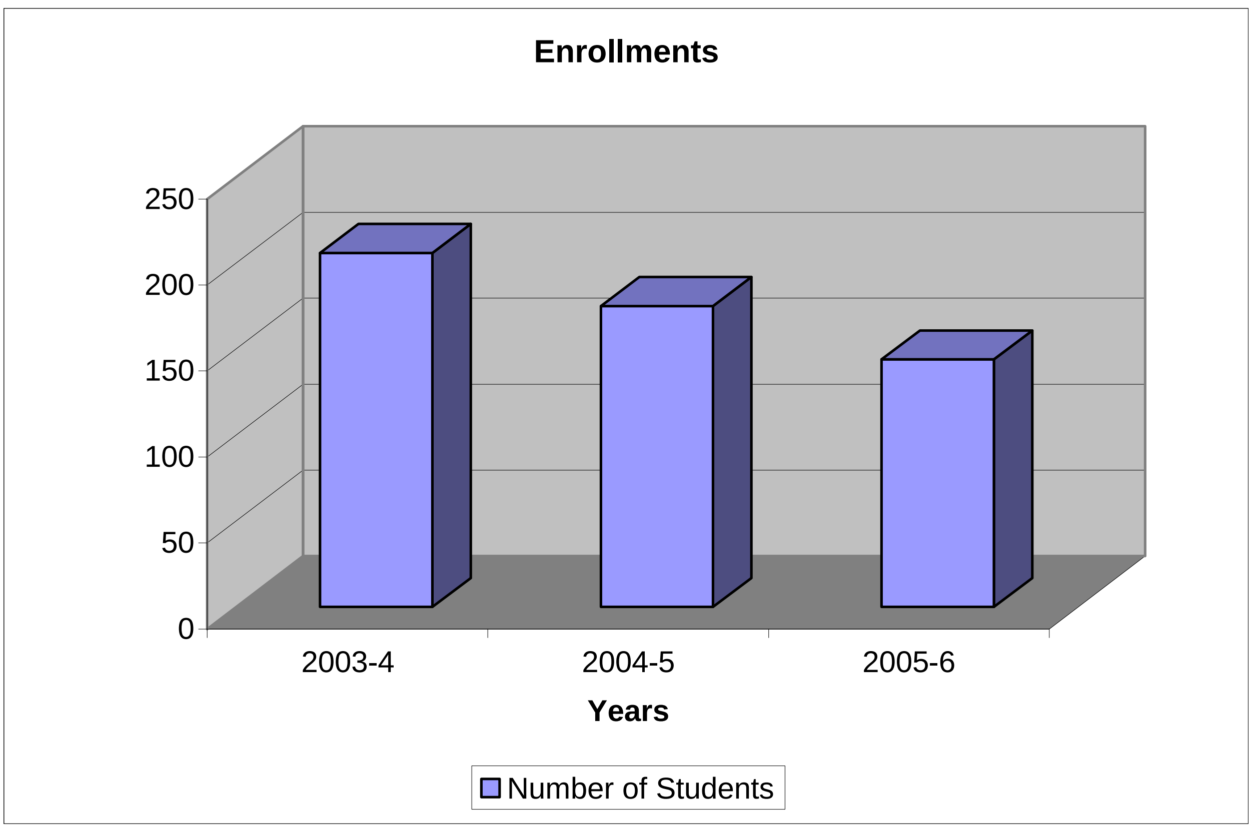

Figure 1

Figure 2 shows enrollments broken out for each of the semesters: fall, spring and summer. Enrollments dropped significantly during the fall semesters. Spring enrollments dropped significantly from the first year to the second, then remained stable from the second to the third. Summer enrollments remained low but stable over the summer semesters. Bob Bradshaw taught Statics during Summer 2005 and Spring 2006. Dr. Howard Rathbun taught Statics during the Summer 2006, which might account for the stability in those semesters from the previous year.

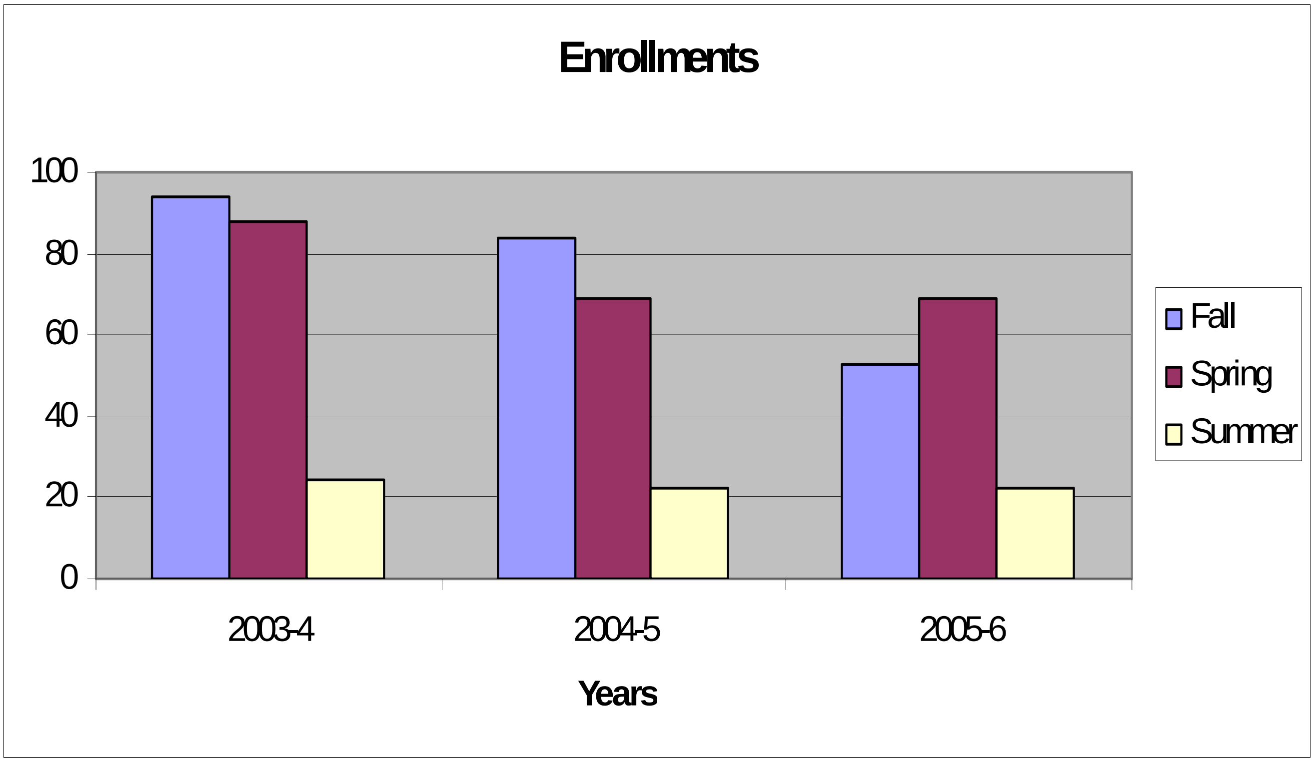

Figure 2

Figure 3 is a very interesting one, showing only spring semesters (including the present one). Note the significant rise in enrollments for spring 2006-7 semester..

This is the first time that all five engineering courses have been offered – and by five different instructors.

This might lead one to believe that if the courses are available, the students will enroll!!!!!!

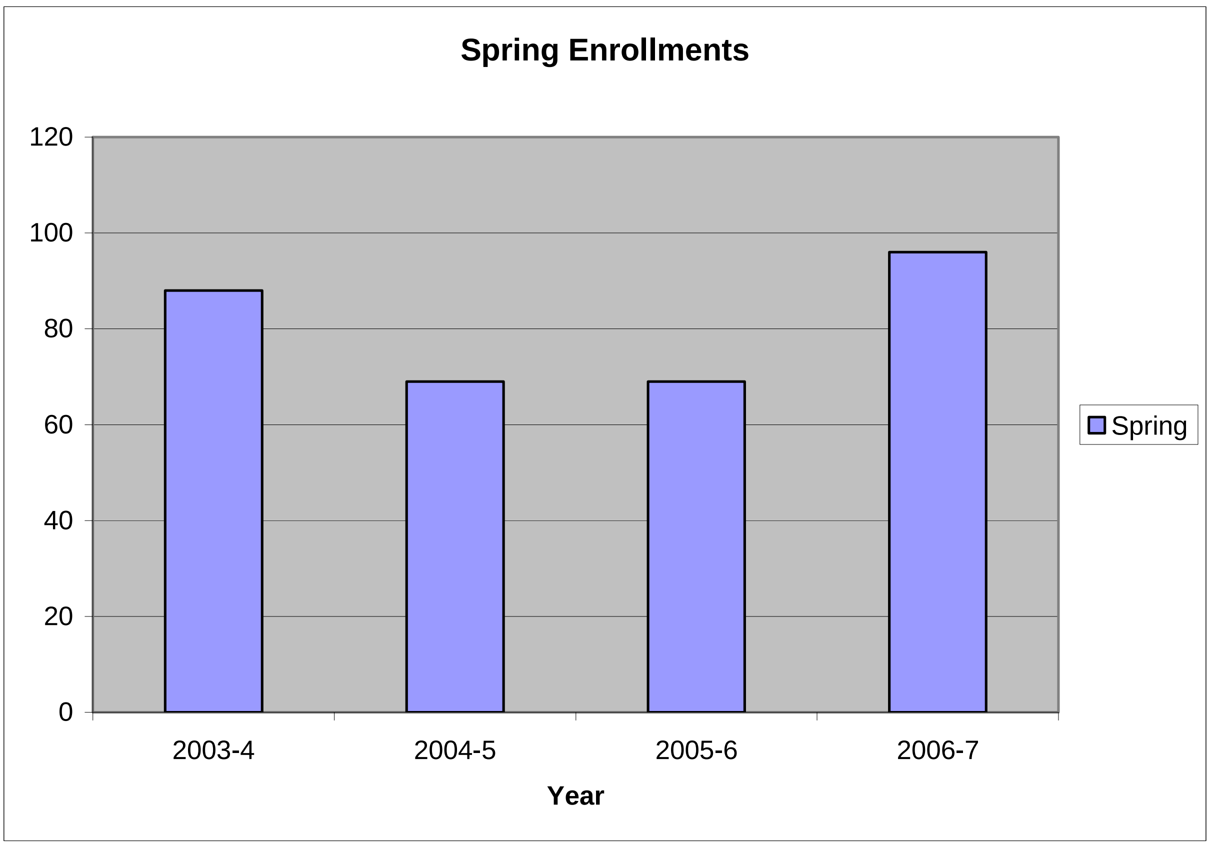

Figure 3

5. Assessment of Program through Review of the Teaching Learning Process

To accomplish this, the following *may* be considered:

- Relevance, appropriateness and currency of student learning outcomes.
- Assessment of teaching strategies.
- Results of classroom assessment techniques.
- Assessment of curriculum revisions, *if applicable*.
- Assessments of the relationships between assignments, criteria, and standards for sequenced courses.
- Assessment of trends in student scores over time, including strengths and needed improvement;
- Adequacy of resource utilization; to include requests *if* there are new resources needed.

5.1 Facilities

This paragraph is taken from ABET "Criteria for Accrediting Engineering Programs".

> "**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."**

- <u>Engineering Laboratory</u>
  The Engineering Lab has had little maintenance since it was built. There are electrical power problems in the building since it was not designed for the loads that are now being placed on it. Much of the equipment is outdated and some does not work. The room needs to be painted. Old posters need to be taken down. The tables have been badly scratched over the years and need to be refinished. Unused equipment needs to be taken off the tables. The tables are very close together and fixed to the floor. This is useful for some classes, not for others. There is equipment in the physics lab that would be very useful in the engineering lab. It is not cost effective to repurchase additional equipment for the engineering lab. Equipment should be shared.

- <u>Centralization of Science and Engineering Laboratories</u>

  Currently science laboratories are spread across campus in three different buildings. There is an urgent need to consolidate all the laboratories in one centralized science center with necessary laboratory staff on hand, should the need arise. This would save precious resources of time and supply due to the much more efficient use of equipment, consumable reagents, and supplies.

  Having a central science center would enhance the safety of the students and the instructors. Engineering labs pose potential risk; even in the best of circumstances. But this risk is increased when the teacher is isolated and overextended. There is no laboratory technician available for engineering and physics. If anything goes wrong, there is no back-up assistance. Many of the instructors are part time instructors and they have little time to spend assembling or disassembling the laboratory equipment, much less repair it if it breaks. Often the instructor is totally alone late at night.

These problems would be remedied if all the sciences were consolidated into one central science center. Around-the-clock availability of a lab technicians would be feasible. Instructors could focus on curriculum development and improved teaching strategies instead of devoting their time to lab set-up and take-down. And most importantly, if an accident occurred, there would be a lab technician available to assist.

- Student Workshop
  It would be very useful to have a small woodworking shop for students to work on projects. A workshop would give students the opportunity to work on projects during class time or when an instructor is on "lab" duty. A portable classroom would even meet this need if it had adequate ventilation. This would greatly enhance student interest and experience, and give them a competitive edge when transferring. NOTE: It is **extremely important** that any workshop be housed separately from any laboratories for **SAFETY** reasons.

5.2 Staffing

This paragraph is taken from ABET "Criteria for Accrediting Engineering Programs".

> **"The faculty is the heart of any educational program. There must be sufficient faculty to accommodate adequate levels of student-faculty interaction, including classroom teaching and laboratory, student advising and counseling, as well as non-student interactions in college service activities, professional development and interactions with industrial and professional practitioners, as well as employers of students."**

- Until 2006, there has been but one faculty member assigned to the engineering department to teach all the courses that are offered as well as to provide student advising, participate as engineering club faculty advisor, attend engineering conferences, and perform other college duties. It has been difficult to offer all the courses each semester. As a result, many students have taken their math and physics classes at Ohlone but deferred their engineering classes to the school to which they were transferring. This in turn has affected the enrollments. It is the classic "chicken and the egg" situation.

- This year, our fulltime engineering instructor took another assignment at the college which allowed him time for only one engineering course. Adjunct instructors were hired to teach the other engineering courses. For the first time, the department was able to teach all of the engineering courses during the spring 2007 semester and our enrollment increased significantly. However, one of these adjunct instructors has already moved on to a position at a fulltime college. In order to keep offering all the classes, it is imperative to keep staff available.

  This leads to the following conclusions:

  - In order to encourage our students to take engineering before they transfer, all courses should be available every semester. One semester isn't enough for our students to trust that their needs will be met and their transfer won't be jeopardized.

- It is virtually impossible for one instructor to have knowledge and experience in all of the engineering areas since engineering is very specialized. Some engineering majors have dropped courses that used to be part of the curriculum. It is necessary to have more than one instructor teaching the curriculum.

- Adjunct instructors will move on if there isn't some incentive for them to stay. This department can grow its enrollments if it has adequate resources.

Recommendation: Rather than attempting to find one "universal" fulltime instructor, employ two halftime instructors with the diverse backgrounds. Two instructors could share the load and adequately cover the range of courses offered. To provide incentive to stay, each half-time instructor would receive full benefits. As enrollments grow, this could possibly grow into two fulltime faculty positions. However, at the present time, the department needs time and resources to generate that growth.

5.3 Recruitment and Retention of Women

Over the last few years, our focus on recruiting and retaining young women has dropped off and the results are evident. This trend has to be reversed. The recruiting course Women in Engineering and Technology ENGI-102 should be re-instituted and offered again at local high schools.

The Society of Women Engineers now offers a new option: For those collegiate groups interested in becoming affiliated with SWE that cannot meet the requirements outlined for a collegiate section, a new option is available – Collegiate Interest Group (CIG). A CIG allows the collegiate members to utilize the name of the Society for group functions, without the need to fulfill all the requirements of a collegiate section. Although CIG collegiate members are entitled to all the individual collegiate membership benefits, the CIG itself will not be entitled to the same benefits as a collegiate section. In other words, a CIG can not request, apply for, or compete for, collegiate section rebates or awards given out annually by the Society. A collegiate member can still apply for, or compete for, individual collegiate awards and scholarships given out annually by the Society. The Engineering Department plans to start a SWE CIG group. Committee member Ms. Felicita Saiez is a Fellow and life member of SWE, as well as, a past national VP of Education for the Society. She has offered to help get a CIG going at Ohlone

5.4 Restructure of Introduction to Engineering course

The Introduction to Engineering ENGI-101 course was assessed and enhanced. There is much more focus on hands-on and design projects. This is a freshman level course which requires no engineering background. Many 4-year universities with full engineering faculties are producing materials for their various classes and placing them on their websites to share with others.

One significant change which has already been implemented has been the removal of the computer applications element from this course. It is now included in a 0.5 unit online class specifically designed to support ENGI-101 and is being taught by a computer applications faculty member. Further, it has been structured as a hybrid course. It has been amplified to include a WebCT course management tool which was added to allow communication with the students through e-mail and online discussions as well as providing a depository for course materials and the syllabus.

The primary focus of the proposed course revision is to introduce students to hands-on projects and to introduce an understanding of the engineering design process using active learning skills. Students will be taught and encouraged to use a team approach to problem-solving. By using the tools taught in the separate computer applications class, they will be able to present their results both orally and in written reports.

By blending all these elements together - i.e., hands-on, teamwork, computer applications, communications skills - students will be prepared to start their working careers as effective and productive engineers able to respond to the challenges that will face them in the 21st century.

The major challenge will be to find enough projects providing the right complexity for the skill level of the students, available resources, and that be accomplished within the time frame.

5.4.1 Future Enhancements

Mr. Jim Laub, Community Committee Member, and former Research Specialist from NASA, has provided some recommendations for this course. He has suggested that the department consider forming a team consisting of all the instructors in the department. (It could also bring in instructors from other disciplines as well, such as Physics, Chemistry, Mathematics). It is well known that humans are very visual. A key element in the thinking processes of any good engineer or researcher is the ability to visualize their project early on. These young students are the same, however; many are still developing the understanding of the steps necessary to complete a task. By having a model (the team of instructors), the students will be able to develop effective tools earlier for dealing with varying ideas, the “loafers”, and learn how to deal with internal conflict before the team becomes dysfunctional. They will also learn how the lead changes hands as a project matures and discipline requirements change.

5.5 Modification of laboratory courses Electric Circuits and Materials Engineering

Adjunct instructors were hired in the areas of Electric Circuits and Materials Engineering. One of their initial tasks was to go through the Engineering Lab and do a sweeping inventory of what was on hand. They then preoceeded to develop new curriculi for their courses. This includes lab manuals and class lab exercises. This has been an enormous addition to our engineering program.

5.6 Student Club Activities

Student club membership is an excellent opportunity to learn many skills unable to be offered in the classroom such as communication with instructors on a more personal level, networking, etc.

For many years, there has been a student club for women. A few years ago, membership was granter to men as well. It has lanquished over the last year. But, this provides an opportunity to change the structure of the student club activity.

Recommendation
Create two new student clubs:

1) Society of Women Engineers CIG, already mentioned above

2) Mathematics, Science and Engineering multidisciplinary club
Engineering does not consist of one discipline. It is richly diverse in mathematics and many other sciences. These disciplines are closesly knitted together. Engineering companies hire all disciplines. One of the ABET stident learning outcomes is the ability for students to work in multidisciplinary teams. Speakers, field trips, and projects would give our students an excellent head start in this area.

6. Assessment of Program Improvement Since Previous Program Review

(Note this step will be implemented during the second program review cycle using these guidelines)

7. Describe Review and Team Dissemination Process

The purpose of the Review and Dissemination Team is twofold:

1) To meet at least once as a group during the review process to provide feedback on the report and serve as the first level of review;

2) To provide an opportunity to educate others about the program or discipline. The members are:

Dr. Ronald Quinta
Dean: Math, Science and Engineering Division

Yvette Niccolls
Program Coordinator: Math, Science and Engineering Division

Linda Messia
Assistant Professor, Mathematics/Engineering

Gary Mishra
Professor, Engineering

Bob Bradshaw
Professor, Mathematics

Dr. Luc Desmedt
Professor, Physics

Nita Shah
Student Member
Candidate for BS in Aerospace Engineering ar San Jose State University, May 2007
Took all Math and Science courses at Ohlone College. Currently taking Introduction to Engineering class at Ohlone College

Mr. James Laub
Community Member
Research Specialist, Nasa Ames Research Center (retired)
Distinguished Ohlone Alumni (2005)

Ms. Felicita Saiez
Community Member
Member: Women in Engineering Advisory Committee
Life Member and Fellow of Society of Women Engineers