Implementing a New Mechanical Engineering Curriculum to Improve Student Retention

Amir Karimi
The University of Texas at San Antonio

Abstract

The mechanical engineering curriculum at The University of Texas at San Antonio (UTSA) was recently revised. The new curriculum is being implemented in the 2000-01 academic year. The main motivations for curriculum revision were enhancement of engineering education quality, increased student retention, and reduced total degree requirement semester hours.

This paper provides tracking data on student enrollment and retention. It will identify measures taken in the new curriculum to improve student success. The paper describes Texas Senate Bill 148 passed by the 75th Legislature in January of 1997, mandating a 42-semester credit hour core curriculum transferable among all Texas public institutions of higher education. The paper explains how the new law impacted UTSA engineering programs and the challenges it created in revising the curriculum to allow a BS degree within four years.

This paper describes the revised curriculum for the 2000-02 catalog that can be completed with a minimum of 130-semester credit hours. We believe that the streamlined curriculum has actually enhanced the quality of our programs.

I. Introduction

The University of Texas at San Antonio (UTSA), a comprehensive state university, was founded in 1969. It is located in the eighth largest city (with a population of 1,114,000[1]) and 30th largest metropolitan area in the country. The Division of Engineering was established in September 1982 offering BS degrees in Civil, Electrical, and Mechanical Engineering (CE, EE, and ME). The first graduating class was in May 1984. Graduate programs offering MS degrees in CE, EE, and ME began in the Fall of 1989; the first MS degree was awarded in Spring 1993. The Division of Engineering, which was originally a part of the College of Sciences and Engineering, became an independent college in 2000 as a result of the university-wide academic restructuring.

<u>Student Demographics:</u> The University of Texas at San Antonio is one of the fastest growing institutions of higher education in the state. In Fall 1982, the student enrollment was approximately 10,000 and in Fall 2000 that figure reached 18,830. The enrollment in Spring 2001 was 17, 979 an increase of 3.11% over previous year. Ethnic minorities have shown steady growth in undergraduate enrollment in the last ten years and UTSA is now designated as a minority institution. Hispanics are the dominant group within the under-represented minorities. The undergraduate students at UTSA are typically older than the traditional students in other institutions. The average age of undergraduate students at UTSA is slightly over 25.

Proceedings of the 2001 American Society for Engineering Education Annual Conference & Exposition

Over 1000 students were enrolled in the College of Engineering in Fall 2000; 931 were identified as undergraduate students and 92 were graduate students. Table 1 summarizes undergraduate engineering student enrollment (Fall 2000) profile by class, gender and ethnicity. The Engineering columns represent the total number of undergraduate students, in each category, in the college. The table entries show both the actual numbers and percentages for each category.

Table 1 indicates that approximately 86% of undergraduate students in the college of engineering were male. The minority student population constituted 62% of the total enrollment. The classification of students in Table 1 is created by the university and is based on the total number of credit hours completed. It does not represent a true standing for many engineering students. For example, the largest group of students in Table 1 is classified as seniors. However, many of these students are taking engineering courses at freshman, sophomore, or junior levels.

The majority of engineering students at UTSA work while attending school. A large number are married and support a family. Some have been out of school for several years and are pursuing engineering education to qualify for a career change. The engineering programs at UTSA have been instrumental in providing educational opportunities for individuals who are bound to San Antonio through employment and family ties.

II. Curriculum Revision Motivations

In November 1998, the mechanical engineering faculty began its deliberation of curriculum revision for the 2000-02 catalog. The major objectives of the catalog revision were to improve the quality of the program offered, increase student retention, and offer a degree program that could be completed in four years. The rationales for these objectives are described below.

Table 1. Undergraduate student profile, by class, gender, and ethnicity, Fall 2000

Class, Gender & Ethnicity	**CE**		**EE**		**ME**		**Engineering**	
	Count	**Percentage**	**Count**	**Percentage**	**Count**	**Percentage**	**Count**	**Percentage**
Freshman	47	22.9%	83	20.1%	69	22.0%	199	21.4%
Sophomore	39	19.0%	72	17.5%	55	17.5%	166	17.8%
Junior	45	22.0%	100	24.3%	58	18.5%	203	21.8%
Senior	74	36.1%	157	38.1%	132	42.0%	363	39.0%
Female	33	16.1%	65	15.8%	29	9.2%	127	13.6%
Male	172	83.9%	347	84.2%	285	90.8%	804	86.4%
White	84	41.0%	146	35.4%	127	40.4%	357	38.3%
African Am.	5	2.4%	27	6.6%	9	2.9%	41	4.4%
Hispanic	107	52.2%	181	43.9%	134	42.7%	422	45.3%
Asian American	4	2.0%	28	6.8%	13	4.1%	45	4.8%
Am. Indian	2	1.0%	2	0.5%	0	0.0%	4	0.4%
International	3	1.5%	28	6.8%	31	9.9%	62	6.7%
Total	205	100%	412	100%	314	100%	931	100%

Statewide Core Curriculum: There is a new state law that requires that a successfully completed 42-semester-credit hour core curriculum be transferable as a block and be an acceptable substitute for a 42-semester credit hour core curriculum at any public college or university in Texas. Since the 42-SCH block can be offered by any institution of higher education, including community colleges, the law mandated that all core curriculum courses be lower division. The new core curriculum policy became effective in the 1999-2000 academic year. The implementation of the new core curriculum increased the minimum requirements for a mechanical engineering BS degree at UTSA from 128 SCH to 138 SCH.

Freshmen Admission: As a public institution, UTSA has an open admission policy and all undergraduate programs, including the engineering programs, follow the same policy. Like most urban, public universities, the admission requirements are minimal. For example, for an entering freshman with a high school graduating class ranking in the bottom 25%, the SAT or ACT score requirements are 970 or 20, respectively. For entering freshmen in the top 25% (but not the top 10%) of their graduating class, the required SAT or ACT scores are 830 or 17, respectively. There is no SAT or ACT minimum requirements for entering freshmen who rank in the top 10% of their high school graduating class[2].

The low admission standards are designed to provide broader public access to higher education. As a result, many students enter the engineering programs with inadequate academic preparation. Without an adequate academic support system, many of these students failed to attain their educational goal. Table 2 shows the range and averages of ACT or SAT scores for first-time entering freshmen into the ME program in Fall 2000. Each minimum or maximum category is not necessarily the data for the same student; therefore, the composite SAT data do not correspond to the sum of verbal or math SAT scores in each category. The average numbers are based on the entire population of entering freshmen who have taken either ACT or SAT exams.

Academic Support System: Low admission standards are designed to provide broader public access to higher education. Unfortunately, not all students entering engineering programs have adequate academic preparation to succeed in their educational pursuit. Without adequate support systems, these students are doomed to failure. Many students entering engineering programs get bogged down with remedial course work, while those with poor study habits end up repeating courses. Student progress towards graduation also had been slowed down in the past due to the inadequate advising and the lack of resources needed to support students with weak academic background.

Student Retention: For some time we were aware of low student retention rates in our mechanical engineering program. We have attempted to determine the underlying cause of the high attrition rate and to find remedies to correct the problem. For example, we have identified a number of foundation courses with a large failure rate.

Table 2. SAT or SAT data on first-time entering freshmen into the ME program in Fall 2000.

	SAT Verb	SAT Math	SAT Comp	ACT Eng	ACT Mat	ACT Soc	ACT Nat	ACT Comp
Minimum	290	380	690	10	15	10	15	14
Maximum	630	710	1340	28	33	36	28	30
Average	474	542	1014	20	22	21	22	21

Table 3 shows a tracking of students enrolled in the ME program in Fall 1996. The data on freshmen and sophomore students show very poor retention rates. After one year only 49% of the Fall 1996 freshmen and sophomores remain in the program. Tracking the same students for two years, Table 3 shows 37 % and 35% retention rates for the 1996 freshmen and sophomores respectively. Factors contributing to high attrition rates include academic failure and students transferring out of the program.

The tracking data at the junior and senior levels show a marked improvement in student retention. Table 3 indicates that after one year 76 % of the juniors are still in the program and after the second year 66 % of these student are either still in the program or have graduated. Table 3 exhibits even higher retention rates for the 1996 seniors. After one year 87 % of the 96 seniors are either still in the program or have graduated. After two years 86 percent of the seniors are either continuing in the program or have graduated. This data suggest that the majority of students who make it through the lower division courses stay with the program. It also suggests that greater attention must be paid at the lower division to improve the student retention rate.

Table 4 summarizes the statistical data on grade distributions in three introductory mechanical engineering courses which students often struggle to pass. The rows, indicated by Fall 1994-Summer 2000, represent the grade distributions for the period. This data shows that nearly 50 % of students enrolled in the course have either received grades lower than “C” or withdrawn from the class. The data clearly indicates that students have difficulties with these classes. Instructors have observed that students lack skills for problem solving techniques. Many students have difficulty applying basis calculus into engineering problem solving.

In 1998 a survey was conducted[3] to determine student opinion on the effectiveness of the existing foundation course work in the engineering curriculum. A total of 114 UTSA students participated in this survey. The majority (110) were upper division (91) or graduate student (19). When asked to identify major factors influencing the learning process in the engineering foundation course work, student responses were as follows: “good teachers (94%), “good textbook” (78%), problem solving sessions (70%), “small class size” (65%), and “student interest” (63%). To improve the quality of education, students suggested assigning well-prepared professors to teach the foundation courses. More hands-on laboratory experience was also recommended.

Table 3. Analysis of mechanical engineering student retention and progress

Fall 1996 ME Students		**1-Year Retention Rate Status of 96-ME Students in Fall 97**							**2-Year Retention Rate Status of 96-ME Students in Fall 97**					
Standing	**#**	**FR**	**SO**	**JR**	**SR**	**GR**	**Total**	**%**	**SO**	**JR**	**SR**	**GR**	**Total**	**%**
Freshman	49	16	8	-	-	-	24	49	13	4	1		18	37
Sophomore	43	-	10	11	0	-	21	49	2	7	6		15	35
Junior	59	-	-	13	32		45	76	-	2	31	6	39	66
Senior	142	-	-	-	89	35	124	87	-	-	47	75	122	86

Table 4. Grade distribution, in percentages, from Fall 1994 through Summer 2000 and Fall 2000 for three introductory courses in Mechanical Engineering.

Course	Period	A	B	C	D	F	W	
Dynamics	Fall 1994-Summer 2000	9.6	16	26.2	15	18.8	14	100
	Fall 2000	6.9	24	24.1	0	20.7	24	100
Solid Mechanics	Fall 1994-Summer 2000	11.1	14.8	23.9	13.1	19.0	18.2	100
	Fall 2000	11.1	16.7	27.8	22.2	5.6	16.7	100
Thermodynamics I	Fall 1994-Summer 2000	14.2	18.9	24.8	10.6	13.6	18.0	100
	Fall 2000	10.3	15.4	35.9	0.0	15.4	23.1	100

III. Impact of State Wide Core Curriculum

In the last fifteen years Texas lawmakers have passed two bills related to core curriculum requirements in public-supported institutions of higher education. House Bill 2183 was passed by the 70th Texas Legislature in 1987 defining "core curriculum" as those courses in liberal arts, humanities, mathematics, sciences, political, social, cultural, and history that all students must complete in order to receive associate or baccalaureate degrees [4,5]. The bill directed all state-supported institutions to develop and implement a high-quality core curriculum for their academic degree programs.

Between 1994 and 1999, there existed two types of Core Curriculum requirements at UTSA: a 54 hour-core in most academic programs and a 48-50 hour-core for those designated as the Alternative Core. A comparison of the General Core and the Alternative Core (for the engineering programs) is summarized in Table 5. The number of semester credit hours (SCH) required in Foreign Languages depended on the students' background and proficiency in the subject. For example, this requirement was waved for international students. As a result, Table 5 shows a range for the total SCH in both the university and engineering core curriculum requirements.

The major feature of the Alternative Core was that 20 SCH of the total 50 SCH were typical engineering core requirements. These included courses in calculus, general chemistry, technical physics, computer programming, engineering economic analysis, and engineering capstone design.

Between 1988 and 1998, all Texas institutions of higher education were developing and implementing their own core curriculum. The outcome (very diverse core curriculum requirements at each state institution) created difficulties in transferring credits between institutions. Realizing that a majority of lower division college students are enrolled in community colleges in Texas and more than half of students in many Texas universities are from the transfer rank, the 75th Legislature passed Senate Bill 148 in January of 1997. This statute repealed all previous legislation related to both lower division transfer and core curriculum. The main objective of the new law was to facilitate transfer of lower division course credit among the state-supported Texas colleges. It directed the Texas Higher Education Coordinating Board to adopt rules allowing any successfully completed lower-division course at one state institution to be substituted for a similar course at any other public college or university.

Table 5. A comparison of the University and the Engineering Core Curricula between 1994-99

Domain	University Core Requirement-1994-99 Catalogs	SCH	Engineering Core Requirement-1994-99 Catalog	SCH
	Component Area		Component Area	
	Rhetoric	6	Rhetoric	6
IA	Mathematics (College Algebra or above)	3	MAT 1214 - Calculus I	4
IB	Science and Technology	6	CHE 1103-General Chemistry PHY 1904-Technical Physics I	3 4
IC	Computer Science/Logic	3	CS 2073-Computer Programming	3
IIA	U.S. History	6	U.S. History	6
IIB	Political Studies	6	Political Science	6
IIC	Social and Behavioral Sciences	3	Social and Behavioral Science	
IID	Economics	3	EGR 3713-Engineering Economics Analysis	3
IIIA	Literature	3	Literature	
IIIB	The Arts	3	The Arts	
IIIC	Language	0-6	Language	0-6
IV	Interdisciplinary Studies	6	CE/EE/ME 4813-Senior Design Project World Civilization	3 6
	Total	**48-54**	Total	**44-50**

The bill also directed the Coordinating Board to adopt rules and identify component areas for a 42-semester credit hour core curriculum to be transferable among the state-supported institutions of higher education. The Coordinating Board identified six (6) component areas for the core curriculum, as summarized in Table 6. The first entry in each box of Table 6 represents the component area (shown in bold) followed by sub-component areas, if any. The total number of hours for each component area are shown in bold and the SCH in sub-component areas are presented in parenthesis ( ).

All state-supported academic institutions and community colleges were instructed to design and implement a core curriculum of no less than 42-lower-division credit hours. In developing a core curriculum, each institution was given the freedom to select and place appropriate courses within each component area. As indicated in Table 6, 36 SCH of course work is required in the first five component areas. Some component areas are further divided into sub-component areas; each requires a specified number of semester hours. To complete the required 42-SCH-core curriculum, institutions were directed to select any additional 6 SCH from one or more areas of the six component areas shown in Table 6.

Institutions were directed to begin honoring student transfer of core courses and core curriculum beginning in fall 1998, and implementing the core curriculum by fall 1999. The new policy states that a successfully completed 42-SCH-core curriculum at one institution must be accepted as a block by all other state institutions. It further mandates that students should not be required to take any additional core curriculum course work, unless the coordinating board has approved a larger core curriculum for the receiving institution.

UTSA's Newly Adopted Core Curriculum: During the 1997-98 academic year, the UTSA Committee on Core Curriculum surveyed the faculty and selected courses for the core as shown in Table 6. The proposed Core Curriculum was submitted to the State's higher education coordinating board and was granted approval in May 1999. The new core curriculum became effective in the 1999-2000 academic year. UTSA's adopted core includes courses in all six component areas. The UTSA core also included contains 3 SCH in Economics.

The change in core curriculum requirements from 54 to 42 SCH enabled most programs at UTSA to either reduce the SCH requirements for a baccalaureate degree or to add specialized courses to their curriculum. However, the implementation of the new Core Curriculum resulted in increasing the minimum requirements for a BS degree from 128 to 138 SCH in the 1999-2000 catalog. This created a challenge for UTSA engineering programs (CE, EE, and ME) as they were attempting to reduce the SCH requirements for a BS degree in engineering for the 2000-02 catalog.

Table 6. Component areas for the new statewide core curriculum policy

Component Area	Required SCH	Possible Additional SCH	Adopted by UTSA SCH
Communication	**6**	**0-6**	**6**
(English rhetoric/ composition)	(6)	(0)	(6)
(composition, speech, modern language/communication skills*)	(0)	(0-6)	
Mathematics	**3**	**0-3**	**3**
(logic, college level algebra equivalent, or above)	(3)	(0)	(3)
(finite math, statistics, calculus, or above)	(0)	(0-3)	(0)
Natural Science	**6**	**0-3**	**6**
Humanities & Visual Performance Arts, must include**:**	**6**	**0-3**	**6**
• Visual Performing Arts	(3)	(0)	(3)
• Other (literature, philosophy, modern or classical language/literature and cultural studies**)	(3)	(0-3)	(3)
Social and Behavioral Sciences, must include:	**15**	**0-3**	**18**
• U.S. History (legislatively mandated)	(6)	(0))	(6)
• Political Sciences (legislatively mandated)	(6)	(0)	(6)
• Social/ Behavioral Sciences	(3)	(0-3)	(3)
• Economics			(3)
Institutionally Designated Option (may include additional semester credit hours in the categories listed above, computer literacy, health/wellness, kinesiology, capstone or interdisciplinary courses, etc.)	**0**	**3**	**3**
Total	**36**	**6**	
Total required SCH in Core Curriculum	**42**		**42**

* Communication: application of modern language means the basic proficiency skills acquired during introductory courses and including a working competency in grammar, writing, speaking, and listening/comprehension in a foreign language.

** Humanities application of language skills includes a study of literature in the original language, and/or the cultural studies related to a modern or classical language.

IV. Revised Curriculum

The mechanical engineering faculty met regularly between November 1998 and December 1999 to revise the curriculum for the 2000-02 catalog. A major goal of the catalog revision was to keep the minimum SCH requirement for a BS degree under 130, without adversely affecting the quality of each program. We successfully completed this task and proposed a degree program for the 2000-02 catalog that could be completed with 130 SCH. The required minimum SCH for the degree program assumes that students choose appropriate courses in mathematics and sciences to satisfy both the core curriculum and engineering requirement. To do this, the students would ideally choose Calculus I, General Chemistry, and Technical Physics to satisfy the core curriculum's 9 SCH requirements in math and sciences.

Through selection of technical elective courses, the ME offers specialization options within its degree program. The options in the program are: i) Thermal/Fluid Systems, ii) Structures and Motions of Mechanical Systems, and iii) General Mechanical Engineering. A suggested Program of Study is shown in Table 7. It contains 32 SCH in math and sciences, 45 SCH in engineering science, and 20 SCH in engineering design including a two-semester sequence in capstone design.

Implementation of the newly adopted core curriculum creates challenges in designing a realistic program of study in engineering. This is not only true for the engineering programs at UTSA, but for all engineering programs in Texas. Since the new statewide core curriculum policy is based only on lower division courses, it is feasible that engineering students complete the core curriculum requirements before attempting any engineering related course. The suggested program of study for the ME program shown in Table 7 was developed to include as many core curriculum courses as possible in the first four semesters. These include General Chemistry, Calculus I, and Technical Physics since they can be used to satisfy both the core curriculum and engineering requirements. With lack of proper advisement, a qualified student might chose different courses to satisfy the math and science portion of the core curriculum. This would result not only in additional hours for the degree, but would also delay the student's graduation. Due to the very structured nature of engineering programs, which requires strict prerequisite enforcement, it is very difficult for students to complete the core courses in the first four semesters and complete the degree in four years (excluding summer sessions). This is true even if a student selects appropriate math and science courses to satisfy both the core curriculum and the engineering requirements.

Engineering students who complete the 42-SCH core curriculum before taking a calculus or technical physics course will soon find themselves with a limited choice of courses to take, due to the lack of required prerequisites. Therefore, the implementation of the new core curriculum requires a stronger need for proper student advisement at the freshman level. It also requires ongoing communication and transfer of information between the senior institutions and community colleges. Without this, the statewide core curriculum policy that is designed to help students transfer semester credit hours, could actually result in an increase in SCH degree requirements and delay graduation for engineering students.

Table 7. ME Suggested Program of Study for the 2000-02 catalog

First Semester				Second semester			
CHE	1103	General Chemistry (core)	3	ENG	1023	Discourse Across the Disc (core)	3
EGR	1103	Exploring Engineering Profession	3	MAT	1223	Calculus II	3
ENG	1013	Freshman Composition (core)	3	ME	1403	Engr. Graphics and Design	3
MAT	1214	Calculus I (core)*	4	PHY	1904	Technical Physics I (core)*	4
		Core Curriculum Course	3	PHY	1911	Technical Physics I Lab	1
						Core Curriculum Course	3
		Total Core Curriculum	*12*			*Total Core Curriculum*	*9*
		Semester Total	**16**			**Semester Total**	**17**
Third Semester				**Fourth Semester**			
EGR	2213	Statics and Dynamics	3	EE	2213	Elec. Circuits & Electronics	3
ME	2323	Applied Engineering Analysis I	3	ME	3103	Kinematics and Dynamics	3
PHY	1924	Technical Physics II	4	STA	2303	Appl. Prob. and Statistics for Engrs.	3
PHY	1931	Technical Physics II Lab	1	ME	3323	Applied Engr Analysis II	3
		Core Curriculum Course	3	ME	3813	Solid Mechanics	3
		Core Curriculum Course	3			Core Curriculum Course	3
		Total Core Curriculum	*6*			*Total Core Curriculum*	*3*
		Semester Total	**17**			**Semester Total**	**18**
Fifth Semester				**Sixth Semester**			
ME	3243	Materials Engineering	3	ME	4293	Thermodynamics II	3
ME	3241	Materials Engineering Lab	1	ME	3663	Fluid Mechanics	3
ME	3293	Thermodynamics I	3	ME	4603	FEA in Mechanical Design	3
ME	3513	Mechanism Design	3			Approved Math/ Science Elective	3
ME	3713	Numerical Methods in ME	3	ECO	2023	Micro Economics (core)	3
ME	3312	Electronics and Data Acquisition Lab	2				
		Core Curriculum Course	3				
		Total Core Curriculum	*3*			*Total Core Curriculum*	*3*
		Semester Total	**18**			**Semester Total**	**15**
Seventh Semester				**Eighth Semester**			
ME	4523	Dynamics of Systems and Control	3	ME		Engr. Design Elective	3
ME	4313	Heat Transfer & Rate Processes	3	ME	4702	Mech. Systems/Control Lab	2
ME	4811	ME Design Project Planning Lab	1	ME	4813	ME Design Project	3
ME		Engr. Design Elective	3	ME	4802	Thermal/Fluid Lab	2
ME		Engr. Sci. Elective	3			Core Curriculum Course	3
		Core Curriculum Course	3				
		Total Core Curriculum	*3*			*Total Core Curriculum*	*3*
		Semester Total (3)	**16**			**Semester Total**	**13**

* Only 3 SCH can be applied towards the core curriculum requirements

Texas' new rule on the 45-hour undergraduate credit limit beyond the degree requirements might create additional problems for engineering students. During the 76th legislative session Section

54.068 of the Texas Education was amended (Senate Bill 345) to allow public institutions of higher education to charge resident students non-resident fees for semester hours attempted in excess of 45 hours beyond hours required for a degree program[5]. The attempted hours include all courses passed, failed, dropped or withdrawn while a student is paying a resident tuition at a public institution in Texas. The new rule applies to all new undergraduate resident students starting Fall 1999. Again, engineering students who do not take appropriate science and math courses to satisfy the core curriculum and engineering requirements, might end up with additional hours which contribute to the undergraduate credit limit.

V. New Curriculum Special Futures

The implementation of the new curriculum began in Fall 2000. The content of the curriculum contains many special features as described below. These features are designed to enhance the educational quality of the program and improve student retention.

EGR 1303 – Exploring the Engineering Profession: This is a new course required by all engineering majors at UTSA. The course format is a three-hour lecture, one-hour laboratory/recitation. The laboratory/recitation hour is limited to small enrollment to allow students hands-on experimentation and student/instructor interaction in problem solving techniques. The course is intended to begin the student's preparation for future engineering practice. Students are introduced to a number of subjects that are necessary tools of engineering. Students are taught study skills, time management, the concept of teamwork, professional ethics, and oral and written communication skills. A series of exciting laboratory demonstrations or experiments are planned for the course to maintain students' interest in the program. The computer application aspect of the course is designed with the strength of current students in mind. Students learn computer basics, word processing, spreadsheets, presentation software, and communication through electronic mail as well as more sophisticated software packages such as MATHLAB.

This course uses a team teaching approach. Although a single faculty is assigned to the course, other faculties provide lectures in their area of expertise. This allows an early exposure to a variety of engineering faculty, as well as quality instruction in various areas. Attempts are made to assign a lead faculty member who has first hand industry experience, can motivate students and keep the course exciting. A part of the course is used to advise students in proper course selection and prepare students for college life.

ME 1403-Engineering Graphics and Design: This is a new 3-semester hour course in engineering graphics, replacing the old 2-hour course. Pro-Engineering has replaced Auto-CAD as the graphic application software for the course. This software is integrated into the curriculum and is used in all courses in the mechanical design areas. One hour of design is included in the course to give students some design experience at the freshman level.

EGR 2323 and EGR 3323-Engineering Analysis I and Engineering Analysis II: These upper level mathematics (beyond differential and integral calculus) are now being taught in the college of engineering. They cover such topics as ordinary differential equations, partial differential equations, vector calculus, and linear algebra. Each course has a recitation hour attached to it to help students in problem solving techniques. The enrollment for recitation hour is limited to 20 to allow student/faculty interaction.

Recitation Hours in Introductory Engineering Courses. To improve student success in engineering foundation courses, one hour of recitation is included in each of the following courses: ME 3103- Kinematics and Dynamics, ME 3293-Thermodynamics I, and ME 3813-Solid Mechanics. Again the enrollment for each recitation section is limited to 20 students. No new materials are covered in the recitation period. Instructors use these periods to answer questions, solve example problems, and involve student in cooperative learning.

Table 4 shows slight improvements in grade distribution in these courses for Fall 2000. However, it is too early to make any rational judgments. The results for Spring 2000 may provide a more acceptable trend.

ME 3173-Numerical Methods in Mechanical Engineering: The Numerical method is being offered in a new format of 2 hours lecture, 3 hours lab. The laboratory is being added to the course for use of application software, including MATLAB, in numerical analysis.

ME 4603-FEA in Mechanical Design: This course has become a required course to introduce students to the application of finite elements in mechanical design. Both Pro-E and ANSYS software are currently used in the course.

Laboratory Experience: All required laboratory courses are being taught independently to ensure that students are receiving hands-on laboratory experience. The one-credit hour of circuit and electronic laboratory is expanded to two semester credit hours in ME 3312. The introduction to data acquisition systems, including LAB View, is included in this course. The use of data acquisition systems is integrated into ME 4702-Mechanical Systems and Controls Lab and ME 4802-Thermal and Fluids Lab.

Design Integration: Design is integrated through-out the curriculum. It is included in many of the required courses. Required courses containing design components are: ME 1403-Engineering Graphics and Design, ME 3312-Electronics and Data Acquisition Laboratory, ME 3513-Mechanism Design, ME 4293-Thermodynamics II, ME 4313-Heat Transfer, ME 4523-Dynamics of Systems and Control, ME 4603-FEA in Mechanical Design, ME 4702-Mechanical Systems and Controls Lab, ME 4802-Thermal and Fluid Lab, ME 4811-ME Design Planning, and ME 4813-ME Design Project. All technical elective courses also have design content. Most project topics in the capstone design sequence, ME 4811 and 4813, are from industry. The industrial support include, mentoring, design project fabrication cost, access to test equipment, and the evaluation of final presentation.

References

1. U.S. Census Bureau, 1999.
2. 2000-01 UTSA Undergraduate Information Bulletin, USPS #982940, Vol. XIX, August 2000, Number 5, p. 64.

3. Karimi, A.; Arroyo, G. A., Passos, A., and Shih, C. S., "Re-Evaluation of Engineering Curriculum Foundation," presented at of the 1998 Annual Meeting of the Gulf-Southwest Section of ASEE, March 25-27, 1998, New Orleans, Louisiana.
4. URL: http:/www.thecb.state.tx.us/divisions/ctc/ip/Core/background.htm; Core Curriculum in Texas: Introduction and Background.
5. URL: http:/www.thecb.state.tx.us/divisions/ctc/ip/Core/finalreport.htm; Report of the Advisory Committee on Core Curriculum, Texas Higher Education Board.
6. 2000-01 UTSA Undergraduate Information Bulletin, USPS #982940, Vol. XIX, August 2000, Number 5, p. 69.

AMIR KARIMI
Amir Karimi is Professor of Mechanical Engineering at The University of Texas at San Antonio (UTSA). He received his Ph.D. degree in Mechanical Engineering from the University of Kentucky in 1982. His teaching and research interests are in thermal sciences. He has been the chair of mechanical engineering twice: the first time between 1997 and 1992 and again from September 1998 to present. Dr. Karimi has served on curriculum committees at all university levels and has been a member of the University Core Curriculum (1993-95 and 1999-present). He is the ASEE Campus Representative at UTSA and is the current ASEE-GSW Section Campus Representative. He chaired the ASEE-GSW section during the 1996-97 academic year.