

Development of Engineering Transfer Program

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Abstract

The engineering transfer program was developed as a cooperative arrangement between the University of Texas of the Permian Basin (UTPB) and the University of Texas at El Paso (UTEP). The first two years of engineering courses are the same for mechanical, industrial, civil, and metallurgical engineering. The students entering the program can complete their first two years at UTPB and then seamlessly transfer for the third and fourth year into any of the above engineering programs at UTEP.

Introduction

Midland/Odessa oil and gas industries wanted us to develop an engineering program, so as to develop the research skills necessary in helping in the oil and gas industry development. Engineering is also viewed by most people as a valued career path [1]. We partnered with the University of Texas at El Paso to offer the first two years of their engineering program at the University of Texas of the Permian Basin. A well-grounded pre-engineering program teaches students technological literacy, scientific inquiry, engineering concepts, and career basics [2].

New Program Development

The degree requirements for the engineering transfer program are given below in Figure 1 with the pre-requisites or co-requisites in parenthesis. The program was designed to meet the research and development needs of the manufacturing and petroleum industry in the Permian Basin of West Texas [3]. One out of ten jobs in the area is related to manufacturing and exploration related to the petroleum industry.

Course Rotation

Based on the degree requirements we developed a course rotation schedule for the faculty that will teach in the program. We plan on having three full time instructors to teach in the engineering transfer and industrial technology programs; a coordinator, a manufacturing instructor, and a petroleum instructor. One instructor is the coordinator (Coord), one instructor will be teaching manufacturing related courses (Mfg), and the third instructor will be teaching petroleum related courses (Pet). The Excel spreadsheet is shown in Figure 2. Part-time instructors will be added in the future based on demand.

BE 1301, 1101 Introduction to Engineering (MATH 2413, ENGL 1301)	MATH 2413 Calculus I	ENGL 1301 English Composition	CHEM 1311 CHEM 1111	HIST 1301
BE 1205 Graphic Fundamentals	MATH 2414 Calculus II (MATH 2413)	ENGL 1302 (ENGL 1301)	PHYS 2325 PHYS 2125 (MATH 2413)	HIST 1302
BE 2434 Mechanics I (MATH 2413)	MATH 2415 Calculus III (MATH 2414)	BE 2326 Engineering Economy (MATH 2413)	PHYS 2326 PHYS 2126 (MATH 2414)	PLSC 2305
BE 2338 Mechanics II (BE 2434, MATH 2414)	MATH 3320 Differential Equations (MATH 2414)	BE 2375 Introduction to Thermal-Fluid Science (BE 2338)	BE 2303 Intro to Material Science and Engineering (CHEM 1311)	BE 2377 Electrical Circuits and Motors (PHYS 2326)

Figure 1: Basic engineering transfer program

Course Description		Instructors		Instructors	
Course no.	Course title	Fa06	Sp07	Fa07	Sp08
Basic Engineering courses					
BE 1205	Graphic Fundamentals		Coord		Coord
BE 2326	Engineering Economy			Pet	
BE 2337	Electrical Circuits and Motors				Coord
BE 1301,1101	Intro to Engineering	Mfg		Pet	
BE 2434	Mechanics I			Mfg	
BE 2338	Mechanics II				Mfg
BE 2303	Intro to Mat. Science and Eng.				Mfg
BE 2375	Intro to Thermal-Fluid Science				Pet

Figure 2: Course Rotation Schedule for Faculty in Engineering Transfer Program

Suggested Courses by semester for students

Based on the course rotation schedule and the degree requirements we developed the suggested courses by semester for the students as shown in Figure 3. We had to make sure that it matched the course rotation schedule and the teaching load for the instructors. Another item to consider is the prerequisites for the various courses. The suggested course work by semester is the most important requirement for a student to make sure that they take the courses in the proper sequence so that they can graduate in four years.

According to a 1992 study by the American College Testing Program [4], the rate of graduation in universities and colleges for the past forty years has been declining. Other statistics indicate that of all freshmen who enter college, only 40 percent complete their

degrees in the standard four-year period [5]. The report by Erickson and Strommer [5] also indicates that more than 50 percent of college students fail to complete their studies. Astin [6] and Reichert and Absher [7] have observed, student attrition in the freshmen and sophomore years has resulted in only 44 percent graduation rate among engineering students. Astin [8] outlines six areas of college involvement: place of residence, athletic involvement, student government, participation in honors program, student-faculty interaction, and academic involvement that strengthen certain types of skills and tends to integrate students into the university community, thereby encouraging them to persist to graduation.

SUGGESTED COURSES BY SEMESTER

Freshman Year

Fall			Spring		
		Hours			Hours
ENGL	1301	3	ENGL	1302	3
MATH	2413	4	MATH	2414	4
HIST	1301	3	HIST	1302	3
CHEM	1311/1111	4	PHYS	2325/2125	4
BE	1301/1101	4	BE	1205	2
Total Hours		18			16

Sophomore Year

Fall			Spring		
		Hours			Hours
PLSC	2305	3	MATH	3320	3
MATH	2415	4	BE	2303	3
PHYS	2326/2126	4	BE	2338	3
BE	2326	3	BE	2375	3
BE	2434	4	BE	2377	3
Total Hours		18			15

Figure 3: Suggested Courses by Semester for the Engineering Transfer Program

Middle and high school pre-engineering programs as another gateway to engineering

High school and middle school teachers are realizing that schools must provide pre-engineering programs that allow students to explore their strengths and interests in engineering and technology [9]. The pre-engineering program at Madison West High School in Wisconsin features a four-year course sequence in engineering and architecture. Engineering students take material science, design/drafting, and engineering I, II, and III. Architectural students take design/drafting/CAD, construction, advanced architecture, and independent study in architecture [10]. Massachusetts has developed a technology/engineering curriculum with help from engineering faculty from the school of engineering at Tufts University showing how science, engineering, and technology can

intersect with course sequences available for students intending to pursue engineering programs at the college level [11]. According to McVearry [12], Project Lead the Way (PLTW) is the nation's premiere program in providing high schools and middle schools with pre-engineering curriculum and linkage to college-level engineering and technology programs. PLTW has grown to 1250 schools in 44 states and Great Britain serving over 160,000 students [13].

Syllabi and lab development

In the meantime, we are also writing the syllabi for the courses that we will be teaching. Based on the textbooks that we have chosen, we are also looking at lab equipment for the courses that have labs. We will be initially developing one lab for AC/DC and another for Instruments and Controls. These labs were developed for the industrial technology program and will also be used to teach the Electrical Circuits and Motors course in the engineering transfer program. We have decided on a classroom/lab design for the two labs as shown in Figure 4. The rooms are designed for a maximum of 20 students. There are several reasons why we chose this design. One of the reasons is obviously saving in the amount of space that needs to be renovated or built. Instead of having two labs and two classrooms, we will be developing only two lab/classrooms. In the future if we have additional funding to develop separate classrooms we can and may go that route. The second reason for developing the lab/classrooms is that when we are discussing the theory, students can readily see what we are talking about. Having two classrooms will also prevent scheduling problems in case we have two classes scheduled at the same time or overlapping times.

We evaluated equipment for the AC/DC Circuits lab and the Instruments and Controls lab from several educational vendors. They include Hampden Engineering Corporation (www.hampden.com), Intellitek (www.intelitek.com), Heathkit Educational Systems (www.heathkit.com), Energy Concepts Inc. (www.eci-info.com), Amatrol (www.amatrol.com), and Lab-Volt (www.labvolt.com). We finally chose the equipment from Amatrol based on the needs of industry in our area.

Advisory Committee

We have also developed an advisory committee list of twenty one members based on the recommendations of our Director of Institutional Advancement. We were primarily interested in people in the manufacturing and petroleum industry, but also included representatives of companies that have a big workforce in the region or those that were interested in the program. All the members are from the Midland, Odessa area, and are within driving distance of the campus. Three of the advisory committee members have already contacted us about job opportunities, internship opportunities, and part-time work opportunities for our students.

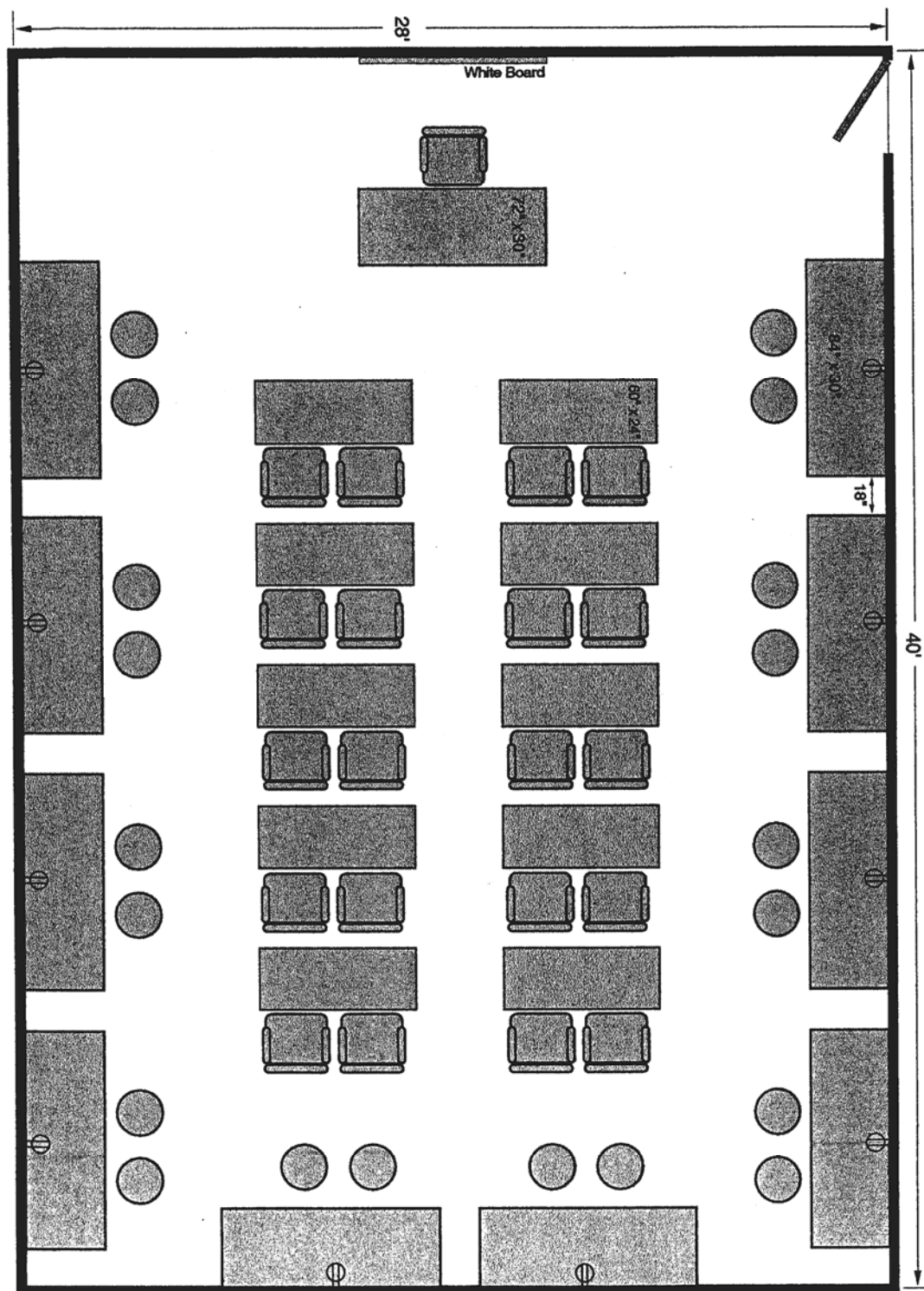


Figure 4: Classroom/Lab Design for AC/DC Lab and Instruments and Controls/Lab

Meeting with industry representatives

We are scheduling meetings with interested employers to further explain our program and encourage them to send their employees to further their education. We are also meeting with employers on the prospective advisory committee list to ask them to serve on the advisory committee and champion our degree to their colleagues. Later we plan on asking them to support our program in any way they can. We are setting up a website where our advisory committee members and others can post employment opportunities and internships. We met with the first industry representative on the afternoon of Wednesday, November 24, 2004. He is the owner of a chemical factory that employs about 100 workers. We toured the facility, and got an idea of what his requirements would be for graduates of our program. He looked over our program and was very supportive of the content of the program. It was a very productive meeting, because by the end of the afternoon he promised to fund us for a hundred thousand dollars over three years.

We met with our next business representative on Tuesday, November 30, 2004 who promised us a hundred thousand dollars matching fund for our program. Another industry representative who we also met on Tuesday, November 30, 2004 manufactures and exports oil and gas separation equipment and employs about 200 people. We met with our fourth industry representatives on Monday, December 6, 2004. They employ about 1000 people and manufacture gas compressors. They were supportive of our program and promised to contribute to our program as well as support their employees with tuitions refunds. Two of their employees have already enrolled in our program. We hosted an industry luncheon on December 17, 2004 at the Odessa Country Club which was attended by over 30 industry representatives. We announced the matching grant funded by one of the business representatives. The objective was to make the local industry aware of our program, to seek additional funding for the program from industry representatives, and to ask them to also support the program.

On February 8, 2005 we were invited to the Natural Gas Society of the Permian Basin meeting, and talked to about sixty industry personnel about our new programs. On February 17, 2005 we were invited to speak to the Odessa East Rotary about our new programs. There were about 25 members present. At the Rotary Club meeting, we got to meet the owner of Westech Seal, Ltd. a small manufacturer of seals mostly used in pumps that employs over 20 people and got to tour his manufacturing facility. He uses both manual and CNC machinery and told us that our students needed training on both types of equipment. He was also willing to hire our students for part-time employment and internships, so that he could develop his workforce. He is planning on expanding, and all his workers are over 45 years of age, and he is finding it difficult to find new employees. We have heard similar comments from several other employers in the region.

Recruiting students and faculty

We plan on having twenty students the first year of the program, and to add twenty students each year there after. We want to grow to about a hundred students in five years. We sent an email to all undecided majors at our university with a copy of the flier that we developed, to see if they would be interested in our program. We are also advertising in

the local newspaper. We now have forty-eight students in the program. Most of the students are already working in jobs related to the oil industry. We also sent a letter with program details to the local high school counselors, and plan on visiting with them once they have had a chance to look at our program. We will then talk to them about our program, and leave additional brochures with them, so that they can give them to interested students.

On March 1, 2005 we met with counselors from Odessa High School. They have a graduating class of 600 students. The counselors were given packages of information about the program. Based on their recommendation we met with the drafting teacher, physics teacher and chemistry teacher since the students that take these classes would be the students that would most probably be interested in joining the program.

We advertised for the two faculty positions, one in manufacturing technology, and the other in petroleum technology. We got 32 responses for the manufacturing position and 5 responses for the petroleum position. Luckily for us, we were able to hire a person for the manufacturing position in fall 2005 who has a background in both manufacturing and petroleum. We decided to re-advertise the petroleum position as we did not have a good enough pool of candidates in 2005. We received good responses for the petroleum position in 2006, and made an offer to a female petroleum faculty and she is starting her teaching starting fall 2006.

The building

We are renovating the old Art Building to be the new Engineering and Technology Building (Figure 5). The Art Department has got a new building. The reason this is of interest is that the building is a single level building and is ideally suited for our purpose. The entire building area is 15,687 square feet and is ideally suited for the engineering and technology building since it is all on one level. The ac/dc, and instruments and controls labs that we developed are 1,174 square feet each. We have been working on the renovation process since fall 2004 and finally got the building renovation completed in time for fall 2005 classes.

So it took almost a year to renovate the initial portion of the building. Keep this in mind when you are starting a new program. For the first year we are renovating only a portion of the building, enough to support two lecture/lab rooms as shown in Figure 4. The offices shown in the figure are already there. The restrooms are also going to be renovated to bring them up to code. The darker portion is the hallway, and some of it is new to bring the building up to code. In spring 2006 we added a manufacturing lab (Figure 6). By spring 2007 we plan on adding the petroleum lab.

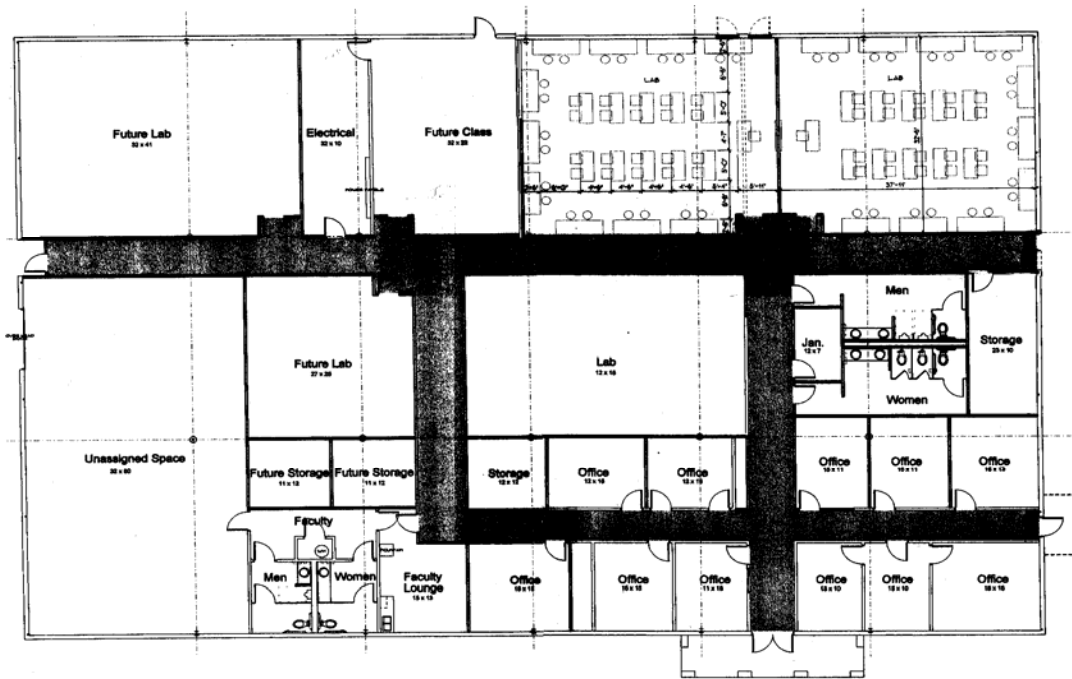


Figure 5: Engineering and Technology Building

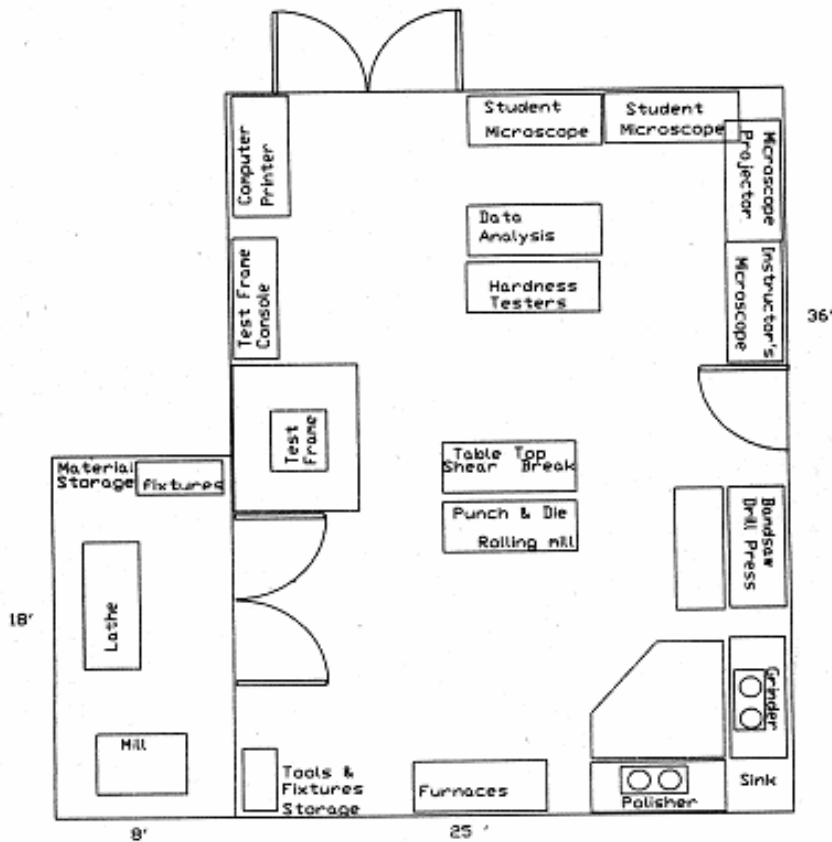


Figure 6: Manufacturing Lab

Summary

We have detailed the process of the development of the engineering transfer program in the School of Business at the University of Texas of the Permian Basin to serve the oil and gas industry. We are remodeling a building for the program and developing labs and courses for the new engineering transfer program which will start in fall 2006. It has been a busy and exciting time as we continue with recruitment of students for the program. As we see engineering enrollment declining nationwide such cooperation can show us ways in reaching more people so we can reverse the trend in engineering enrollment.

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Biography

RAJ DESAI is the Coordinator and founding faculty member of the new Engineering Transfer Program in the School of Business at the University of Texas of the Permian Basin in Odessa, Texas. His academic emphasis and professional interests are in the areas of innovation, and new technologies.