

FOURTH QUARTERLY REPORT (YEAR 5)
(7/1/95 - 9/30/95)
AND
FINAL PROJECT REPORT
(9/29/90 - 9/30/95)

**MINORITY UNDERGRADUATE
TRAINING FOR ENERGY-RELATED
CAREERS (MUTEC)**

Submitted to

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INTRODUCTION

This report is the fourth quarterly report of the fifth year and also the final report for the project. We will discuss each item separately and give you an idea of how far we have gotten.

TECHNICAL PROGRESS

1. Developing Engineering Modules

At present, we have completed all the pre-engineering modules (math to include five subtopics, physics and chemistry) as well as all the engineering modules (statics, dynamics, strength of materials, fluids, thermodynamics, electrical engineering, engineering economy and materials science). The video tapes have been placed in the main library and are accessible for student review at any time. This service is extremely helpful to those part-time and full-time students who may need to preview or review the fundamental engineering courses at their own pace. A booklet has been generated giving the topics covered in each tape. A copy was submitted to DOE during the first quarter of this year.

2. Continuing the Restructured Engineering Program

The restructure of the engineering science curriculum within Mechanical Engineering is continuing. In conjunction with the Gateway Program of the NSF, restructuring that began back during the first year, has now encompassed all the engineering programs at FIU. This includes the re-"engineering" of the lower division courses to minimize duplication and to change the focus to a more "design oriented" curriculum. A review of the lower division Gateway curriculum that may impact on all engineering programs has been completed. Some of the suggestions made as a result of

MUTEC are being implemented such as the Introduction to Engineering course and the System Dynamics course. The opposition from the Physics department has been neutralized. Minimization of course duplication will enable students to receive their degrees within 120 credits as is being mandated by the Florida Legislature. Implementation of a college-wide curriculum has started as of Fall 1995.

The Mechanical Engineering program continues to offer the new subprogram options related to MUTEC. They are: 1) the Heating, Ventilating, and Air Conditioning (HVAC) option; and 2) the Electro-mechanical option.

3. Continuing the Pre-Engineering Exam

The developed pre-engineering examination in previous years of the grant was sent to Estela Romo for use as a candidate for entrance examination in other schools. The examination is available for use by the college and it appears that with all the curriculum changes, this aspect of the project will be accepted as an entrance examination to the engineering programs. At present, readiness tests in Statics, Dynamics, and other basic sciences are being used in the interim. Based on the results of the readiness test, students are being directed to the pre-engineering modules.

4. Pre-Engineering Modules

The modules have been placed in the library for use by students. Faculty members are informed each semester through the engineering information network's electronic mail (e-mail) and, in the past, by advertisement in the student newspaper. Faculty have been asked to refer students to the modules when needed.

5. Developing the EF Exam

The EF Exam developed in the early part of this grant was also sent to Estela Romo for use as a comprehensive examination candidate by other schools. This examination, as a tool by students in preparation for the EIT, has not been as successful as we had hoped. We will be offering the examination again in the spring semester soon after the semester begins.

6. Implementing FLAME Courses and TUGS Projects

The **FLAME** courses and the **TUGS** projects continue to be implemented. FLAME students are being used to help instruct students in another DOE program--PREP. The FLAME courses created are offered regularly to the students with the help of FIU faculty and student mentors. This part of the project will continue, irrespective of MUTECH. In this new academic year we have had 21 students returning to the FLAME program and 27 entering the program.

Students participate with their mentors on the **TUGS** projects. Feedback occurs during weekly meetings with their mentors and other co-workers. So far this grant year, we had 12 returning students and 4 new students. Overall, we have had 32 participants, and we have had a total of 15 students graduate, five of which have gone to graduate school and one supported by MUTECH has graduated with an MS degree.

7. Evaluating the Pre-Engineering Exam

The test results from the readiness tests given during the statics and dynamics courses have evaluated to determine areas of student weakness. This is in lieu of the Pre-engineering Exam. Once the outcome of the pre-engineering examination has been

discussed and accepted by the College, its implementation and evaluation will follow.

8. Evaluating the Pre-Engineering and Engineering Modules

The engineering and pre-engineering modules are now available in the main library of FIU. Students are asked at the end of the tapes to give an evaluation of the tape and to contact Dr. Levy if they have any questions. Some of the modules have received good reviews, others less than expected from Engineering Honors students enrolled in the Introduction to Engineering and System Dynamics courses. Dr. Ed LeMaster of UT-Pan American has reviewed some of the tapes and has commented quite favorably. In fact, I have sent Dr. LeMaster 30 tapes (3 in statics, 4 in dynamics and 3 in mechanics of materials, 3 in fluid mechanics, 3 in materials engineering, 3 in thermodynamics, 8 in electrical engineering and 3 in engineering economics) are now being used by UT-Pan American's engineering tutorial laboratory as reference material.

9. Evaluating the EF Exam

Evaluation of the EF exams have been completed for the examinations given. The first exam provided the basis against which future exams are to be evaluated. Based on student critique of the exam, the second exam was modified. All future exams will track the effectiveness of the EF exam. So far, we have had 40 students take the examination from all the engineering departments in the college.

10. Evaluating the FLAME Courses and TUFGS Projects

The developed FLAME courses and TUFGS projects will continue to be evaluated throughout this year, through student and advisor comments. So far this new academic year, we have 21 students in 12th grade in FLAME, another 27 students in 11th grade that

are expected to continue in the program next year in the FLAME program. Only the 12th graders are taking the FLAME specific classes described in previous reports.

Students participate with their mentors on the TUFGS projects. Feedback occurs during weekly meetings with their mentors and other co-workers. So far this grant year, we had 12 returning students and four new students. Overall, we have had 32 participants, and we have had a total of 15 students graduate five of which have gone to graduate school and one has graduated from graduate school.

11. Evaluating Introductory Engineering Courses

The faculty in the Mechanical Engineering Department have actively participated in the introductory engineering courses. Seminars have been given to introduce the students to basic engineering concepts and various engineering fields. Student evaluations are being conducted at the end of each semester. Thus far, the evaluations have been favorable as to content and instructors.

The Introduction to Engineering courses has been successful. It has been offered at the freshman entry level as well as at the transfer student level. So far, through Fall semester 1995, 774 people have taken the course in 22 separate classes since its inception in 1992-1993. Of those, 602 were males. Hispanics comprised the ethnic majority with 467 students. One hundred African-Americans, 167 Caucasians, and 39 of Asian descent also took the course. In the six classes offered during the Fall semester, 120 males and 30 females have taken this course, of which 102 are Hispanics, eighteen are African Americans, five are Asian Americans and 25 are Caucasian.

12. Fourth Quarter, Fifth Year

We are still creating electronic lecture notes for use with gathered notes, problem

questions, etc., as well as the inclusion of the videotapes and other available material (such as ICISS question banks) for the self-paced course. We are formalizing this information in terms of lecture notes for use in the self-paced course.

The FLAME student pipeline continues to provide students at a rate of 20-30 new high school students/year. The Introduction to Engineering Course is also a very large source of students that might come into the MUTECH program and the TUFGS program as well. So far, we have attracted a total of 32 students to the research experience, exceeding our overall target of 25. We have contacted both the Electrical Engineering Department, FIU, and Miami-Dade Community College to try and increase the number of students working through TUFGS. Miami-Dade Community College has provided us with one student. Since funding has basically run out, students who are still with the program are being supported through other grants.

13. Overall Evaluation of the FIU-MUTECH Project

First, all the co-investigators, Drs. Yih, Ebadian, Roig and I, would like to thank the Department of Energy's Minority Impact Office for awarding FIU with the MUTECH grant for the past five years. We believe it has made a difference, especially in the creation of a new, streamlined curriculum that began with the Mechanical Engineering Program and has now become college wide. Second, we have given 774 students an introduction to engineering, something that did not exist 3 years ago. Third, we have given FLAME the opportunity to participate in this program through the equivalent introduction to engineering course. Over 150 of those students have participated and have a 100% record of completing the program once they start. Over 80% of those students have gone on to

college. Fourth, we have aided 32 undergraduates continue in their engineering studies. Of those half have already graduated, and half of those have gone on to graduate school. One of these graduate school students has graduated with an MSME and another has won an NSF Scholarship. Fifth, we have created a bank of 51 2-hour tapes in 10 science and engineering science areas and covered the spectrum of math courses from geometry/trigonometry to differential equations. Sixth, we have created two examinations for use in preparation for entry into the engineering programs and in preparation for the EIT. Seventh, we have created a streamlined curriculum and four options, two of which are energy related. From, these points, we believe that the program was *very successful* and for that we wish to thank the Department of Energy and specifically Ms. Estela Romo for her unwavering support.

MINORITY UNDERGRADUATE TRAINING FOR ENERGY-RELATED CAREERS
QUARTERLY AND FINAL STATISTICAL REPORT

School Florida International University Reporting Period 4th QTR FY 94-95 & FINAL REPORT

Do not count participants more than once.	Current Year - (94 - 95)		(90-94) Prior (c)	TOTAL (a)+(b)+(c)
	New to MUTEC (a)	Returning Participants (b)		
I. STUDENT STATUS				
A. HIGH SCHOOL PARTICIPANTS				
1. Enrichment/Concurrent Enrollment				
a. Graduated and continued to post-secondary		26	100	126
b. Graduated and did not continue to post-secondary			23	23
c. Still in high school	27	21	0	48
d. Dropped out of high school				
SUB TOTAL	27	47	123	202
RETENTION RATE (a+b+c divided by total)				100 %

2. COMMUNITY COLLEGES	Current Year - (94 - 95)		(90-94) Prior (c)	TOTAL (a)+(b)+(c)
	New to MUTEC (a)	Returning Participants (b)		
1. Transferred to four-year institution		1		1
2. Still in program				
3. Completed program but did not transfer to four-year institution				
4. Dropped				
SUB TOTAL (1 to 4)		1		1
RETENTION RATE (1+2+3 divided by total)				100%

C. FOUR-YEAR INSTITUTION PARTICIPANTS	Current Year - (94 - 95)		(90-94) Prior (c)	TOTAL (a)+(b)+(c)
	New to MUTEC (a)	Returning Participants (b)		
1. Still an undergraduate	4 *	12	1	16
2. Graduated & has energy related job		3	1	4
3. Graduated & has non-energy-related job		1	1	2
4. Graduated and has no job		2		2
5. Graduated & attending grad school in energy-related discipline		2	5	7
6. Graduated & attending grad school in non-energy-related discipline				
7. Dropped				
SUB TOTAL (1-7)	4	20	8	32
RETENTION RATE (1 to 6 divided by total)				100%
GRAND TOTAL (sub-totals of A+B+C)	31	67	137	235

DOESN'T INCLUDE INTRO TO ENG. STUDENTS: 440 PRIOR TO 1995; 334 IN 1995

* TWO STUDENTS ARE TRANSFERS. OF ALL THE INTRO TO ENG STUDENTS 242 ARE TRANSFERS

II.	Current Year - (94 - 95)		(90-94) Prior (c)	TOTAL (a)+(b)+(c)
	New to MUTEC (a)	Returning Participants (b)		
Do not count participants more than once.				
STUDENT PROFILE - include all educational levels:	OTHER 1	OTHER 1	OTHER 2	4
African American	20	42	101	163
Hispanic (other than Puerto Rican)	9	17	33	59
Puerto Rican				
Asian/Pacific Islander	1	7	1	9
Native American				
Native Alaskan				
TOTAL	31	67	137	235

III. RESEARCH EXPERIENCE	Current Year - (94 - 95)				Non Mutec Program Minority Students
	No. of students with Research Experience at:	New to MUTEC (a)	Returning Participants (b)	(90-94) Prior (c)	
Educational Institution Laboratory	4	15	14	33	UNK
DOE or Federal Laboratory		3	5	8	
Industry or Other University Labs					
As a Result of Modified Curriculum					
Other					
TOTAL	4	18	19	41	

IV. SCHOLARSHIPS	
Total No. of Scholarships given from start of program to present	61
Average Scholarship Dollar Amount	~ 2000
Average No. of Scholarships per Student	2 - 4

V. PROGRAM ACTIVITIES (check all that apply to your MUTEC project)	
Curriculum Modification	
High School	
Community College	
Four-Year Institution	X
Tutor/Mentor Support	
High School	x
Community College	x
Four-Year College	x
Financial Assistance/Scholarships	x
Faculty Enrichment	
Number of participants:	
Internships	x
Bridge Programs/Summer Workshops	x
Other (specify) LAB EXPERIENCE AT FIU	x

What benefits to your institution have been realized as a result of this program? (e.g., curriculum enhancement, spinoff programs, additional Federal funding, linkages.)

CURRICULUM ENHANCEMENT
STUDENT LAB EXPERIENG / RESEARCH EXPERIENCE
GIT PREP EXAMS
GRAD SCHOOL OPPORTUNITY

In your opinion, what are the major barriers to students success in completing an energy related field of study? How did this program address those barriers?

TOUGH PROGRAM RGR'TS
FINANCIAL HELP WITH AVAILABLE FUNDS

Discussion of problems/issues:

SOME OF THE GOALS -
SELF PACED CLASS START } HAD TO SLIP
DUE TO UNFORSEEN
PROBLEMS

What were typical reasons for students dropping out of the MUTECH Program?

N/A

What recommendations do you have for future Federal assistance?

NEED MORE FUNDS FOR PROGRAM TO CONTINUE

MINORITY UNDERGRADUATE TRAINING FOR ENERGY-RELATED CAREERS QUARTERLY REPORT

School FLORIDA INT'L UNIVReporting Period 4TH QTR FY 94-95
& FINAL REPORT

DISCUSSION OF PROBLEMS/ISSUES

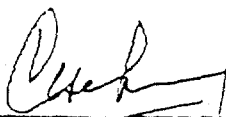
NEED MORE MOCK EIT EXAM STUDENTS
BOOKLET FOR VIDEOS TOO SLOW TO COMPLETE
SOME MATERIALS FOR SELF PACE TO BE COMPLETED
MORE STUDENTS IN TVFGS

ACCOMPLISHMENTS

TAPE LIBRARY
RESEARCH EXPERIENCE FOR MINORITIES
MINORITIES TO GRAD SCHOOL
MOCK EIT EXAM FOR STUDENTS
INTRO TO ENG. CLASS
FLAME ENG. CLASS
SELF PACE MTR'L
FORMER MUTC STUDENT WINS NSF MINORITY SCHOLARSHIP!
FORMER MUTC STUDENT GRADUATES WITH MSME!

PLANNED CORRECTIVE ACTIONS/RECOMMENDATIONS FOR NEXT QUARTER

- BOOKLET FOR VIDEOS MUST BE COMPLETED - DONE
- NEED MORE TVFGS STUDENTS
- NEED ELNS FOR SELF-PACE - HIRED ONE MORE FOR THIS JOB

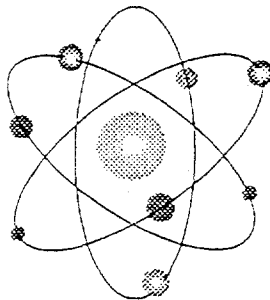

Signature

12/29/95

MINORITY UNDERGRADUATE TRAINING IN ENERGY RELATED CAREERS (DOE/MUTEC)

TAPE SERIES

titled under "MUTEC"
at Florida International University library



Available for student use
in preparation for the EIT examination

Coordinated by: Dr. Cesar Levy
Florida International University
Department of Mechanical Engineering

April, 1995

MUTEC PROJECT TAPES

<u>TOPIC</u>	<u>INSTRUCTOR</u>	<u>TAPE #</u>	<u>CONTENTS</u>
Statics	Dr. Perl	1	Equivalent systems and resultants, equilibrium, truss analysis by method of joints.
		2	Truss analysis by method of sections, zero force members, frames and machines friction.
		3	Friction, centroids, moments of inertia.
Dynamics	Dr. Levy	1	Particle motion, projectile motion, coordinate systems, Newton's 2nd law of motion, velocity and acceleration, kinematics of particles, energy.
		2	Conservation of energy, impulse and momentum (linear and angular), impact.
		3	Planar motion of rigid body, vector method.
		4	Relative motion of rigid bodies, assorted problems.
Mechanics and Materials	Dr. Perl	1	Stress and strain, extension due to a variable force, total deformation, internal forces, safety factor, pressure vessels, shear, twisting forces, thermal expansion, bimetal.
		2	Bending of beams, shear and movement diagrams, maximum movement in beams.
		3	Maximum stresses in beams, deflection of beams.

<u>TOPIC</u>	<u>INSTRUCTOR</u>	<u>TAPE</u>	<u>CONTENTS</u>
Chemistry	Mr. Solomon	1	States of matter, chemical change, physical and chemical properties, elements, chemical formulas, chemical reactions, units, measurement methods and errors, conservation of energy/mass, atomic theorm, radioactivity.
		2	Periodic table, electrons and their energy states, bonds between elements (covalent), molecular weights.
		3	Stoichiometry, heat and energy, gases (Graham's law of diffusion, brownian motion, kinetic molecular theory, deviations from ideal behavior, critical temperature, cooling by expansion), Advogadro's number, gas law.
		4	Liquids (properties, equilibrium vapor pressure, boiling points), solids (properties, structures, lattices, defects in lattices, determination of structures).
		5	Solutions, acids and bases, pH levels, precipitation, solubility, stoichometry in solutions, activation energy and reaction energy methods.
		6	Electrical energy and chemical change, electrolysis, electrical conductivity, galvanic cells oxidation potential, balanced equations by half reactions.
Material Science	Dr. Munroe	1	Crystallography, unit cell, lattice structures, Miller indices.
		2	Binary phase diagram, defects in structures, solid diffusion.
		3	Mechanical properties (strength, hardness, difficulty stiffness) stress and strain, load application.
Thermodynamics	Dr. Pujol	1	Properties of a pure substance, gas properties, tabulated properties, steam tables.
		2	First law of thermodynamics, work and heat.
		3	Application of first law, second law of thermodynamics, entropy, irreversibility.

<u>TOPIC</u>	<u>INSTRUCTOR</u>	<u>TAPE#</u>	<u>CONTENTS</u>
Fluid Mechanics	Dr. Schoephoerster	1	Basic concepts in fluid mechanics, conservation of mass, momentum and energy, control volume analysis.
		2	Differential analysis, experimental analysis.
		3	Internal flow (flow in pipes) external flow (drag lift).
Electrical Engineering	Dr. Yen	1 (2 tapes)	DC circuits, circuit elements: resistors, capacitors and inductors, Coulomb's law, equivalent circuits, Kirchoff's laws, DC power, Ohm's law.
		2 (2 tapes)	Sample problems.
		3 (2 tapes)	Transient circuits, AC power: (apparent power, reactive power, power factor) AC circuits, root-mean-square, operational amplifiers, magnetic fields.
Magnetic Fields	Dr. Yen	1	Electrical/mechanical energy, flux linkage, permeability, magnetic circuits.
		2	Transformers, DC motors, generators.
Engineering Economics	Dr. Carrasco	1	Time value of money.
		2	Discounted cash flows, present worth analysis, equivalent annual worth comparisons, rate of return analysis, replacement analysis, lease-or-buy decisions, break-even analysis.
		3	After tax analysis.