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9. ABSTRACT

The Kenyan Government and Egerton College requested that the Agricultural Engineering program at the college be expanded and specialized to more adequately meet the professional needs of the country. The expansion of the program will be in three major areas: farm power and machinery, soil and water conservation, and water resources development. Recent emphasis in Kenya on rehabilitation of range lands and development of rural water supplies has increased the need for skilled personnel in soil and water conservation and in water resource development. This report serves to fulfill the contractual objectives of: providing the Government of Kenya with consultant services necessary in upgrading and development of curriculum; planning installation and operation and maintenance of water installations; and presenting requirements for staff, training facilities and equipment for the above program. Each new area of concentration will have 30 students per year which means that there will be about 270 students in the department. The expanded program will require at least a 4-fold increase in personnel. There is a lack of adequately trained staff in the country and a need for an intensive expatriate training program for Kenyans. The increase in enrollment and staff will require a corresponding increase in buildings and equipment. With the addition of these facilities and staff the college will be able to produce well trained men who can begin to fill the void of farm power and machinery, soil and water conservation and water resource specialists which now exists within the country.

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COLLEGE OF ENGINEERING

DEPARTMENT OF
AGRICULTURAL
AND IRRIGATION
ENGINEERING
UMC 41

April 7, 1978

Mr. William Jone
c/o Sheldon Cole
AFR/DR/EAP
Department of State
New State Building Room 2446
Washington, D. C. 20523

Dear Mr. Jones:

Enclosed are five copies of my final report under Contract # AID/Afr-C-1140, Work Order 24. The purpose of the contract was to assist in developing an expanded curriculum for the Agricultural Engineering Department of Egerton College in Kenya. I consider this report as completion of my obligation. I trust that it will serve the needs of USAID, and more particularly, the needs of Egerton College. Twenty-five copies of the report have been sent to Mr. Frank Abercrombie in Nairobi.

The experience in Kenya was very enjoyable for me. I express my appreciation to you for giving me the opportunity to participate in this project.

Sincerely,

Glen E. Stringham

Glen E. Stringham
Associate Professor

GES:jae

Enclosure

ACKNOWLEDGMENT

The experience of preparing the report has been most enjoyable. I would like to express my appreciation to all who worked with me and gave so generously of their time to share ideas and who have in any way aided in the preparation of this report. I wish to express my gratitude to Frank Abercrombi and Ray Hofforth of USAID/Nairobi for the time they gave for orientation, for counsel, and for providing the support facilities needed for the completion of this work.

The work at Egerton College was a delight. The faculty of the College were most courteous, and their efforts to make my stay enjoyable were successful. I am particularly indebted to the staff of the Agricultural Engineering Department for the many hours they shared with me in discussing the program that has been developed. Special thanks go to Dr. Peter Misiko, Department Head, and to Mr. Charles Garman, Head of the Department for four of the last six years, for their help. Without it, the work could not have been accomplished.

I also wish to thank the typists. The secretaries in the USAID/Nairobi offices were most gracious to me and put aside other important work to get the draft typed before I had to leave the country. I am also grateful to Mrs. Amy Krambule for typing the final draft. It carries with it the very professional appearance which is the trademark of her

Glen E. Stringham

TABLE OF CONTENTS

	Page
RECOMMENDATIONS	1
INTRODUCTION	3
Objective	3
CURRENT PROGRAM	4
Curriculum	4
Physical Facilities	5
Staff and Teaching Loads	6
THE NEW PROGRAM	7
Farm Power and Machinery	7
Soil and Water Conservation	10
Water Resources	11
Overview	14
STAFF NEEDS	28
Needs for Current Program	28
Needs for the Expanded Program	28
Expatriate Staff	29
TRAINING NEEDS	31
NEEDS FOR NEW PHYSICAL FACILITIES	32
EQUIPMENT NEEDS	34
Farm Power and Machinery Equipment	35
Soil and Water and Water Resources Equipment	40
Equipment for Support Courses	42
PROGRAM PHASE-IN	46
ALLOWANCE FOR TEXT BOOKS	50
SUMMARY	52
APPENDIX I. Existing Course Schedules	54
APPENDIX II. Proposed New Courses	75
APPENDIX III. Staff Requirements	81

page 39 missing and unobtainable.

LIST OF TABLES

Table		Page
1.	Expanded Curriculum for the Farm Power and Machinery Stream	8
2.	Expanded Curriculum for the Soil and Water Stream	12
3.	Expanded Curriculum for the Water Resources Stream	15
4.	Comparative Curriculum for the Farm Power and Machinery, Soil and Water, and Water Resource Streams	17
5.	Courses to be Taught in the Agricultural Engineering Department	23
6.	Summary of Staff Requirements for the Expanded Agricultural Engineering Program	30

LIST OF FIGURES

Figure		Page
1.	Phase-in of New Curriculum in the Agricultural Engineering Department	47
2.	Construction Timetable for the Agricultural Engineering Department	48
3.	Staff Requirements for the Agricultural Engineering Department	49
4.	Summary Chart of the Staff Requirements for the Agricultural Engineering Department	51

RECOMMENDATIONS

In response to a request to review the Agricultural Engineering curriculum at Egerton College near Njoro, Kenya, and consider the possibility of expanding the curriculum, the following recommendations are made:

1. The curriculum should be divided into three streams:
   a. Farm Power and Machinery
   b. Soil and Water Conservation
   c. Water Resource Development
2. Each stream should produce thirty graduates per year.
3. Since the Department is currently severely understaffed, three new lecturers and three new demonstrators should be recruited to begin duties in May 1978. If they are not available by then, the Department must either curtail the number of service courses offered, or cease to exist. The present staff cannot operate the full program.
4. Staff strength should be increased to twenty-three lecturers and thirty-eight demonstrators by the time the expansion is complete.
5. Since qualified Kenyan staff either do not exist or are emloyed elsewhere, immediate openings must be filled by expatriate staff. Recruiting should begin immediately.
6. A training program for potential Kenyan Staff should begin immediately. At least five potential lecturers and five potential demonstrators should be sent abroad each year until the expatriate staff are replaced.
7. Potential lecturers should be encouraged to obtain at least a Master of Science degree in Agricultural Engineering. Potential Demonstrators should be sent to vocational schools and technical colleges which emphasize practical experience.
8. The following facilities will need to be constructed and equipped:
   a. Three classrooms.
   b. One field shed for field lectures and demonstrations.
   c. Two new laboratories--water resources, soil mechanics, and structures.
   d. Additions to and expansion of existing labs and shops.
   e. Forty-five office spaces.
   f. Space for support programs--surveying, material and tool stores, machinery and tractor storage areas, etc.

9. The program should be phased in over a 5-year period, adding the Soil and Water Conservation Stream at the beginning of the 3rd year, and the Water Resource Development Stream at the beginning of the 5th year.

10. Students should be given, or requested to buy their professional textbooks.

11. The expansion should be carried forward.

INTRODUCTION

Egerton College, located five kilometers south of the village of Njoro, Kenya, is a small agricultural college. Students are admitted after 11 to 13 years in primary and secondary schools, and after 3 years at Egerton, are awarded a diploma in one of the 9 different areas. Agricultural Engineering is one of those areas. The current emphasis in the Agricultural Engineering Department is on farm machinery and farm power. Other courses in farm structures, soil and water, farm electrification and food processing are also required, but the main thrust of courses is the farm-power farm-machinery stream.

Recent added emphasis in Kenya on rehabilitation of range lands, and development of rural water supplies, has increased the need for skilled personnel in soil and water conservation, and in water resource development. To meet this need the Ministry of Education has requested Egerton College to add two new streams of emphasis to its Agricultural Engineering (AE) program. The new streams are to be in soil and water conservation and in water resource development.

Objective

The Government of Kenya requested, through USAID/Kenya, the services of a consultant to work with the officials of Egerton College in the development of the AE curriculum to include the new streams. The obj

> To provide the Government of Kenya with consultant services necessary in upgrading and development of curriculum in . . . agricultural engineering with emphasis on water development.

from Egerton College, including

> planning, installation and operation and maintenance of water installations.

In addition to curriculum recommendations,

requirements for staff, training facilities and equipment for the above program.

was also to be presented.

This report will attempt to fulfill those objectives.

CURRENT PROGRAM

In order to place the new curriculum in proper perspective, it is considered necessary to present a brief synopsis of the current program, and to briefly describe the existing shop and laboratory facilities.

Curriculum

The curriculum description and its intentions can best be described by quoting from the 1977 catalogue.

> This diploma course is designed to teach the practical knowledge of Agricultural Engineering as it applies to East African conditions. Major emphasis throughout the three years is placed on Workshop Practice, Farm Power and Machinery, Soil and Water Conservation Utilization, Structures, Crop Husbandry and Economic Management. All related subsidiary courses are shown in the syllabus. Vacation periods are used for additional practical training either at Government Establishments or with private farms. This is considered as an important part of the students training.
>
> Throughout the curriculum practical training work is conducted both in the field and in the workshop. Practical classes are kept small in order to allow students the maximum opportunity to participate in all types of work. This procedure allows the instructor maximum contact with each student. In practicals involving the use of hand shop tools and surveying equipment a practical group usually has between 15 and 20 students. In laboratories where students are using power tools or farm machinery the safety hazard is potentially greater. These groups are then kept below 12 students per instructor.

In the practicals, students are expected to engage in a variety of minor and major projects. Examples are as: learning to drive tractors and operate most of the commonly used farm machinery, servicing of farm tractors and machinery; maintenance of petrol and diesel enginers and major repair work up to and including fitting piston rings, bearings, and valve reconditioning; building terraces and repairing roads; building concrete bridges, pole type shed and renovating stone and wooden buildings; complete overhauls of different types of farm machinery, installing electrical power wiring and various types of control systems

During the last term the students are taken on a weekly field trip of one day each. These trips include visits to tea, sisal, coffee and sugar plantations, small manufacturing plants, settlement schemes, food processing plants, Kenya Polytechnic Laboratories, and Government Research Stations.

Students are taken on one major tour during their final year, where they visit industrial establishments such as the Lister Engine Assembly Plant, East African Railways Corporation Workshop, Timsales, and Survey of Kenya, Irrigation Schemes and other large scale mechanized activities.

The Agricultural Engineering Diplomates are qualified to fill positions as Workshop Managers, Tractor and Machinery Unit Supervisors, Soil Conservation Construction Unit Supervisors, Plantation Factory Managers, Commercial Farm Machinery Sales and Service, and Mechanization Extension Officers. Many of the diplomates are also entering teaching positions.

The actual schedule of courses and the catalogue description of each course are given in Appendix I.

Physical Facilities

The physical facilities of the AE department consist of two lecture rooms, a drawing room, seven laboratories, workshop areas variety farm machinery and farm power units, several small fields where the practical parts of some courses are presented, and a 30 hectare tuition farm where students can carryout their individual crop production projects.

The lecture rooms have a seating capacity of 96 and 36 students, respectively. They are kept busy most of the year by the AE classes,

and are used as well by other departments. They are equipped for all methods of regular instruction.

The drafting room is equipped to handle forty students, and seems to be meeting current needs.

The welding and woodworking shops are inadequately equipped for current needs, let alone being capable of accommodating an increased students load. Recommendations for improvement will be given later.

The farm power and machinery labs are also too small to properly handle current student loads. Furthermore, much of the demonstration equipment is badly in need of replacement. Here again, recommendations for improvement will be given later.

The equipment that is available in the shops is generally of good quality, and capable of withstanding the high abuse that comes in a teaching-learning situation. There is simply not enough to handle the student load, especially if some of the equipment is down for repair.

Staff and Teaching Loads

There are currently 6 staff members who hold the rank of lecturer, five of whom have at least a B.S. degree from a recognized university. However, at the end of March, one of the staff will be leaving to accept a position as a lecturer on the Agricultural Engineering staff of the University of Nairobi. The department also has 5 demonstrators who work with the lecturers, mainly in the presentation and supervision of the practical parts of the courses.

Teaching loads are excessive. Teaching loads requiring in excess of 25 actual, in-class, hours per week are common, and often exceed 0 contact hours. It is a credit to the quality of the staff that the uality of teaching is holding up as well as it is under such adverse onditions. There is a desperate need, however, for an immediate ncrease in the number of staff in the department.

THE NEW PROGRAM

The proposed curriculum expansion, and the dividing of the area of emphasis into three streams, will permit greater depth of training in three areas which are badly needed in the Kenyan society.

Farm Power and Machinery

Students graduating in the Farm Power and Machinery stream, will have had training and experience in: tractor operation and maintenance; engine overhaul; trouble shooting engine malfunctions; tune-up procedures; principles of farm machinery operation; care and operation of farm machinery; farm machinery repair; use of oxen and small tractors; care and maintenance of small farm equipment; basic principles pertaining to the other streams; elementary economics; extension methods; and leadership skills.

As a result of his training and experience, he will be able to do minor overhaul of farm power units; do major tune-up work on engines, both gasoline and diesel; do major maintenance work on farm power units; properly operate a wide variety of farm machinery; carry out routine maintenance of farm machinery; do major overhaul on farm machinery; teach these principles and techniques to others; supervise and direct farm machinery operations.

He will be able to find employment with: Government organizations where machinery is an important part of the work: Extension services to teach farm machinery principles to farmers; colleges and universities as demonstrators and farm machinery managers; large farming companies as supervisors of the farm machinery, and with farm machinery sales and service companies as sales representatives or servicemen.

The detailed outline of the new curriculum is given in Table 1.

Table 1. Expanded Curriculum for the Farm Power and Machinery Stream.

YEAR I			
Term I			
Chem	313	40	Chemistry for Engineers
Educ	711	30	Introduction to Language Communications
Eng	817	50	Mathematics
Eng	818	50	Surveying I
Eng	820	40	Welding
Eng	825	60	Workshop
Eng	841A	50	Tractor Service and Operation
		320 hrs.	
Term II			
Homec	041) 032)	30	Family Development and Nutrition
Chem	322	60	Soil Physics
Econ	611	20	Price Theory and Market Formation
Eng	815	40	Drawing I
Eng	826	40	Power Shop Equipment
Eng	840	50	Farm Machinery Workshop
Eng	841B	40	Tractor Service and Operation
		280 hrs.	
Term III			
Chem	321	60	Soil and Fertilizer Chemistry
Econ	613	30	Production Economics
Eng	813	50	Physics
Eng	816	40	Drawing II
Eng	842	40	Oxen and Small Equipment
Eng	845A	50	Farm Machinery I
Eng	860	40	Statics
		310 hrs.	

Table 1. Continued

		YEAR II	
Term I			
Crops	412B	30	Principles of Crop Production
Econ	621) 631)	40	Title to be determined (Records, Accounts, Management)
Eng	830A	50	Electric Power I - Fundamentals
Eng	843A	50	Farm Power I - Small Engine Repair
Eng	845B	50	Farm Machinery II
Eng	850A	50	Fluid Mechanics
Eng	861	40	Strength of Materials
		310 hrs.	
Term II			
Crops	424	40	Perennial and Annual Crops
Eng	843B	50	Farm Power II - Engine Electrical Systems
Eng	845C	50	Farm Machinery III
Eng	847	60	Conservation Equipment
Eng	848	70	Farm Machinery Management
Eng	851	50	Soil and Water Conservation
		320 hrs.	
Term III			
Educ	712	20	Technical Report Writing
Educ	751	30	Introduction to Rural Sociology
Eng	843C	50	Farm Power III - Testing and Trouble Shooting
Eng	844	50	Farm Power Trains
Eng	853	50	Water Supply and Irrigation
Eng	863	60	Building Design Engineering
Eng	876A	40	Field Experience I
		300 hrs.	
		YEAR III	
Term I			
Educ	731B	60	Educational Technology
Educ	752	20	Principles of Extension Education
Educ	828	40	Workshop Management
Eng	832A	50	Process Engineering I
Eng	849	40	Hydraulic Systems
Eng	871A	10	Student Projects I
Eng	875A	40	Machinery Repair Practice I
Eng	876B	40	Field Experience II
		300 hrs.	

Table 1. Continued.

Term II			
Educ	753	30	Extension Program Planning
Econ	614	30	Economic Development
Eng	831	40	Plant Engineering
Eng	832B	50	Process Engineering II
Eng	871B	50	Student Projects II
Eng	875B	40	Machinery Repair Practice II
Eng	876C	40	Field Experience III
		280 hrs	
Term III			
Educ	756	20	Government Procedures
Eng	872	40	Outside Visits
Eng	874	20	Seminars
		80 hrs.	

Soil and Water Conservation

Students graduating in the Soil and Water stream will have had training and experience in operation and maintenance of conservation equipment; fluid mechanics and hydraulics; surveying; design and construction of terraces, grassed waterways, drop-structures and other conservation structures; hydrology; operation and maintenance of pumps; design and construction of overhead and surface irrigation systems; land use planning; basic principles pertaining to the other streams; elementary economics; extension methods; and leadership skills.

As a result of his training and experience, he will be able to layout and construct conservation projects; supervise construction of conservation works; layout and construct irrigation schemes and distribution systems; plan soil and water conservation projects; and teach these basic principles to others.

He will be able to find employment with Government agencies involved in soil and water conservation and irrigation development; extension services to teach conservation and irrigation principles to farmers and ranchers; colleges and universities as demonstrators or supervisors of conservation and irrigation projects; large farming companies as supervisors of conservation and irrigation projects and systems; and with conservation and irrigation companies as sales representatives or service personnel.

The detailed outline of the new soil and water curriculum is given in Table 2.

Water Resources

Students graduating in the Water Resources stream will have had training and experience in operation and maintenance of conservation equipment; fluid mechanics and hydraulics; hydrology and meteorology; surveying; operation and maintenance of pumps; wiring and installation of electric motors; design and construction of pipelines, canal systems, and rural water systems; planning water resource systems; construction and maintenance of dug wells, bore holes, storage and catchment ponds, and water harvesting sites; design and construction of small, earth-fill dams; basic principles pertaining to the other streams; elementary economics; extension methods; and leadership skills.

As a result of his training and experience, he will be able to lay out and construct pipeline systems; layout and construct rural water supply systems; maintain wells and bore-holes; maintain and perform simple repairs of pumps; design and construct water harvesting installations, underground tanks (storage ponds), and small dams and reservoirs; plan overall water resource systems; supervise water resource projects; and teach the basics of good water resource management to others.

He will be able to find employment with Government agencies involved with water resource development; extension services to teach

Table 2. Expanded Curriculum for the Soil and Water Stream

YEAR I			
Term I			
Chem	313	40	Chemistry for Engineers
Educ	711	30	Introduction to Language Communication
Eng	817	50	Mathematics
Eng	818	50	Surveying I
Eng	820	40	Welding
Eng	825	60	Workshop
Eng	841	50	Tractor Service and Operation
		320 hrs.	
Term II			
Homec	032) 041)	30	Family Development and Nutrition
Chem	322	60	Soil Physics
Econ	611	20	Price Theory and Market Formation
Bio	214	20	Ecology
Eng	813A	40	Mechanics
Eng	815	40	Drawing I
Eng	826	40	Power Shop Equipment
Eng	840	50	Farm Machinery Workshop
		300 hrs.	
Term III			
Chem	321	60	Soil and Fertilizer Chemistry
Eng	813B	50	Elementary Thermodynamics
Eng	816	40	Drawing II
Eng	842	40	Oxen and Small Equipment
Eng	846	60	Farm Power and Machinery
Eng	860	40	Statics
		290 hrs.	
YEAR II			
Term I			
Crops	412B	30	Principles of Crop Production
Econ	621) 631)	40	Farm Records, Accounts and Management
Eng	843A	50	Farm Power I - Small Engine Repair
Eng	850A	50	Fluid Mechanics I - Fundamentals
Eng	861	40	Strength of Materials
Eng	880	60	Hydrology and Meteorology
Eng	881	50	Pumps and Pumping
		320 hrs.	

Table 2. Continued

Term II			
Eng	819	50	Surveying II
Eng	830A	50	Electric Power I - Fundamentals
Eng	847	60	Conservation Equipment
Eng	850B	50	Fluid Mechanics II - Hydraulics
Eng	851A	60	Soil and Water Conservation - Utilization
Eng	864	40	Soil Mechanics
		310 hrs.	
Term III			
Educ	712	20	Technical Report Writing
Educ	751	30	Introduction to Rural Sociology
Eng	830B	50	Electric Power II - Application
Eng	851C	50	Soil and Water Engineering
Eng	854	50	Water Supply and Sewerage
Eng	856A	40	Field Experience I
Eng	863	60	Building Design Engineering
		300 hrs.	
		YEAR III	
Term I			
Educ	731B	60	Educational Technology II
Educ	752	20	Principles of Extension Education
Eng	832A	50	Process Engineering
Eng	855A	50	Overhead Irrigation
Eng	856B	40	Field Experience II
Eng	857A	10	Student Projects I
		230 hrs.	
Term II			
Educ	753	30	Extension Program Planning
Econ	614	30	Economic Development
Eng	831	40	Plant Engineering
Eng	855B	50	Surface Irrigation
Eng	855C	30	Drainage
Eng	856C	40	Field Experience III
Eng	857B	30	Student Projects II
Eng	858	50	Land Use Planning
		300 hrs.	
Term III			
Educ	756	20	Government Procedures
Eng	872	40	Outside Visits
Eng	874	20	Seminars
		80 hrs.	

water resource management to others; Government and private farms and ranches in development of water supplies; rural areas and small villages in development of rural water supplies; colleges and universities as demonstrators and supervisors of water resource systems; water resource equipment dealers as sales and service representative; and with private construction firms as construction supervisors.

The detailed outline of the new soil and water curriculum is given in Table 3.

Overview

There are many similarities in the three curriculums. In order to give a perspective on the similarities and differences of each stream, Table 4 has been prepared which shows on a term by term basis, the common courses taken by all three streams and the different courses taken by each stream.

In order to accommodate the new streams and strengthen the farm power and machinery stream, it will be necessary to add 24 new courses to the curriculum. The catalogue descriptions of the new courses are given in Appendix II.

With the 24 new courses, the Agricultural Engineering Department will be teaching a total of 88 courses. Of the 88 courses, 69 will be for the engineers alone, 10 will be for engineers and students in other departments, and 9 will be strictly service courses to meet the needs of other departments. A complete list of all courses is given in Table 5. The table also shows which courses are new, which ones are existing, which ones are being revised, for whom the courses are designed, and how many hours per term each students will be in each class.

Table 3. Expanded Curriculum for the Water Resources Stream.

YEAR I			
Term I			
Chem	313	40	Chemistry for Engineers
Educ	711	30	Introduction to Language Communication
Eng	817	50	Mathematics
Eng	818	50	Surveying I
Eng	820	40	Welding
Eng	825	60	Workshop
Eng	841	50	Tractor Service and Operation
		320 hrs.	
Term II			
Homec	032) 041)	30	Family Development and Nutrition
Chem	322	60	Soil Physics
Econ	611	20	Price Theory and Market Formation
Bio	214	20	Ecology
Eng	813A	40	Mechanics
Eng	815	40	Drawing I
Eng	826	40	Power Shop Equipment
Eng	840	50	Farm Machinery Workshop
		300 hrs.	
Term III			
Chem	321	60	Soil and Fertilizer Chemistry
Eng	813B	50	Elementary Thermodynamics
Eng	816	40	Drawing II
Eng	842	40	Oxen and Small Equipment
Eng	846	60	Farm Power and Machinery
Eng	860	40	Statics
		290 hrs.	
YEAR II			
Term I			
Crops	412B	30	Principles of Crop Production
Econ	621) 631)	40	Farm Records, Accounts and Management
Eng	843A	50	Farm Power I - Small Engine Repair
Eng	850A	50	Fluid Mechanics I - Fundamentals
Eng	861	40	Strength of Materials
Eng	880	60	Hydrology and Meteorology
Eng	881	50	Pumps and Pumping
		320 hrs.	

Table 3. Continued.

Term II			
Eng	819	50	Surveying II
Eng	830A	50	Electric Power I - Fundamentals
Eng	847	60	Conservation Equipment
Eng	850B	50	Fluid Mechanics II - Hydraulics
Eng	851A	60	Soil and Water Conservation - Utilization
Eng	864	40	Soil Mechanics
		310 hrs.	
Term III			
Educ	712	20	Technical Report Writing
Educ	751	30	Introduction to Rural Sociology
Eng	830B	50	Electric Power II - Application
Eng	851C	50	Soil and Water Engineering
Eng	863	60	Building Design Engineering
Eng	882	50	Water Resource Systems
Eng	886A	40	Field Experience I
		300 hrs.	

YEAR III

Term I			
Educ	731B	60	Educational Technology II
Educ	752	20	Principles of Extension Education
Eng	832A	50	Process Engineering I
Eng	883	30	Water Resource Planning
Eng	885	50	Dams and Spillways
Eng	886B	40	Field Experience II
Eng	887A	10	Student Projects I
Eng	888	30	Water Law and Government Policy
		290 hrs.	
Term II			
Educ	753	30	Extension Program Planning
Econ	614	30	Economic Development
Eng	831	40	Plant Engineering
Eng	855C	30	Drainage
Eng	884	50	Water Resource Supply
Eng	885C	40	Field Experience III
Eng	887B	30	Student Projects II
		250 hrs.	
Term III			
Educ	756	20	Government Procedures
Eng	872	40	Outside Visits
Eng	874	20	Seminars
		80 hrs.	

Table 4. Comparative Curriculum for the Farm Power and Machinery, Soil and Water, and Water Resource Streams.

YEAR I - TERM I

Common Courses for All Three Streams

Chem	313	40	Chemistry for Engineers
Educ	711	30	Introduction to Language Communication
Eng	817	50	Mathematics
Eng	818	50	Surveying I
Eng	820	40	Welding Practice
Eng	825	60	Workshop
Eng	841A	50	Tractor Servicing and Operation
		320 hrs.	

Total for all three streams - 320 hrs.

YEAR I - TERM II

Common Courses for All Three Streams

Homec	032) 041)	30	Family Development and Nutrition
Chem	322	60	Soil Physics
Econ	611	20	Price Theory and Market Formation
Eng	815	40	Drawing
Eng	826	40	Power Shop Equipment
Eng	840	50	Farm Machinery Workshop
		240 hrs.	

Courses for FP and M Stream

Eng	841B	40	Tractor Service and Operation
		40 hrs.	

Total for FP and M Stream - 280 Hrs.

Common Courses for S&W and WR Streams

Bio	214	20	Ecology
Eng	813A	40	Mechanics
		60 hrs	

Total for S&W Stream = 300 hrs.
Total for WR Stream = 300 hrs.

Table 4. Continued

YEAR I - TERM III

Common Courses for all Three Streams

Chem	321	60	Soil and Fertilizer Chemistry
Eng	816	40	Drawing II
Eng	842	40	Oxen and Small Equipment
Eng	860	40	Statics
		180 hrs.	

Courses for FP & M Stream

Econ	613	30	Production Economics
Eng	813	50	Physics
Eng	845A	50	Farm Machinery I
		130 hrs.	

Common Courses for S&W and WR Streams

Eng	813B	50	Elementary Thermodynamics
Eng	846	60	Farm Power and Machinery
		110 hrs.	

Total for S&W Stream = 290 hrs.

Total for WR Stream = 290 hrs.

YEAR II - TERM I

Common Courses for all Three Streams

Crops	412B	30	Principles of Crop Production
Econ	621) 631)	40	Farm Records, Accounts and Management
Eng	843A	50	Farm Power I - Small Engine Repair
Eng	850A	50	Fluid Mechanics I - Fundamentals
Eng	861	40	Strength of Materials
		210 hrs.	

Courses for FP & M Stream

Eng	830A	50	Electric Power I - Fundamentals
Eng	845B	50	Farm Machinery II
		100 hrs.	

Common Courses for S&W and WR Streams

Eng	880	60	Hydrology and Meteorology
Eng	881	50	Pumps and Pumping
		110 hrs.	

Total for S&W Stream = 320 hrs.

Total for WR Stream = 320 hrs.

Table 4. Continued

YEAR II - TERM II

Common Courses for all Three Streams

Eng	847	60	Conservation Equipment
		60 hrs.	

Courses for FP & M Stream

Crops	424	40	Perennial and Annual Crops
Eng	843B	50	Farm Power II - Engine Electrical Systems
Eng	845C	50	Farm Machinery III
Eng	848	70	Farm Machinery Management
Eng	851	50	Soil and Water Conservation
		260 hrs.	

Total for FP & M Stream = 320 hrs.

Common Courses for S&W and WR Streams

Eng	819	50	Surveying II
Eng	830A	50	Electric Power I - Fundamentals
Eng	850B	50	Fluid Mechanics II - Hydraulics
Eng	851A	60	Soil and Water Conservation - Utilization
Eng	864	40	Soil Mechanics
		250 hours	

Total for S&W Stream = 310 hrs.

Total for WR Stream = 310 hrs.

YEAR II - TERM III

Common Courses for all Three Streams

Educ	712	20	Technical Report Writing
Educ	751	30	Introduction to Rural Sociology
Eng	863	60	Building Design Engineering
		110 hrs.	

Courses for FP & M Stream

Eng	843C	50	Farm Power III - Testing and Trouble Shooting
Eng	844	50	Farm Power Trains
Eng	853	50	Water Supply and Irrigation
Eng	876A	40	Field Experience I
		190 hrs.	

Total for FP&M Stream = 300 hrs.

Table 4. Continued

YEAR II - TERM III (Cont.)

Common Courses for S&W and WR Streams

Eng	830B	50	Electric Power II - Applications
Eng	851C	50	Soil and Water Engineering
		100 hrs.	

Courses for S&W Stream

Eng	854	50	Water Supply and Sewerage
Eng	856A	40	Field Experience I
		90 hrs.	

Total for S&W Stream = 300 hrs.

Courses for WR Stream

Eng	882	50	Water Resource Systems
Eng	886A	40	Field Experience I
		90 hrs.	

Total for WR Stream = 300 hrs.

YEAR III - TERM I

Common Courses for All Three Streams

Educ	731B	60	Educational Technology II
Educ	752	20	Principles of Extension Education
Eng	832A	50	Process Engineering I
		130 hrs.	

Courses for FP & M Stream

Eng	828	40	Workshop Management
Eng	849	40	Hydraulic Systems
Eng	871A	10	Student Projects I
Eng	875A	40	Machinery Repair Practice I
Eng	875B	40	Field Experience II
		170 hrs.	

Total for FP & M Stream = 300 hrs.

Table 4. Continued

YEAR III - TERM I (Cont.)

Courses for S&W Stream

Eng	855A	50	Overhead Irrigation
Eng	856B	40	Field Experience II
Eng	857A	10	Student Projects I
		100 hrs.	

Total for S&W Stream = 230 hrs.

Courses for WR Stream

Eng	883	30	Water Resource Planning
Eng	885	50	Dams and Spillways
Eng	886B	40	Field Experience II
Eng	887A	10	Student Projects I
Eng	888	30	Water Law and Government Policy
		160 hrs.	

Total for WR Stream = 290 hrs.

YEAR III - TERM II

Common Courses for all Three Streams

Educ	753	30	Extension Program Planning
Econ	614	30	Economic Development
Eng	831	40	Plant Engineering
		100 hrs.	

Courses for FP & M Stream

Eng	832B	50	Process Engineering II
Eng	871B	50	Student Projects II
Eng	875B	40	Machinery Repair Practice II
Eng	876C	40	Field Experience III
		180 hrs.	

Total for FP & M Stream = 280 hrs.

Common Courses for S&W and WR Stream

Eng	855C	30	Drainage
		30 hrs.	

Table 4. Continued

YEAR III - TERM II (Cont.)

Courses for S&W Stream

Eng	855B	50	Surface Irrigation
Eng	856C	40	Field Experience III
Eng	857B	30	Student Projects II
Eng	858	50	Land Use Planning
		170 hrs.	

Total for S&W Stream = 300 hrs.

Courses for WR Stream

Eng	884	50	Water Resource Supply
Eng	886	40	Field Experience III
Eng	887B	30	Student Projects II
		120 hrs.	

Total for WR Stream = 250 hrs.

YEAR III - TERM III

Common Courses for All Three Streams

Educ	756	20	Government Procedures
Eng	872	40	Outside Visits
Eng	874	20	Seminars
		80 hrs.	

Total for all three streams = 80 hrs.

Table 5. Courses to be Taught in the Agricultural Engineering Department.

Service	Eng	New	Revise	Exist	Number	Hrs	Title
X				X	Eng 811	30	Introductory Statistics
	FP&M			X	Eng 813	40	Physics
	S&W WR			X	Eng 813A	40	Mechanics
	S&W WR				Eng 813B	50	Elementary Thermodynamics
X				X	Eng 814	30	Elementary Sketching
	X			X	Eng 815	40	Drawing I
	X			X	Eng 816	40	Drawing II
	X			X	Eng 817	50	Mathematics
X	X			X	Eng 818	50	Surveying I
	S&W WR			X	Eng 819	50	Surveying II
	X			X	Eng 820	40	Welding Practice
X				X	Eng 823	40	Workshop Fabrication
X				X	Eng 824	40	Woodworking and Sketching
X	X			X	Eng 825	60	Workshop
X	X			X	Eng 826	40	Power Shop Equipment
	RP&M	X			Eng 828	40	Workshop Management
X	X			Delete	Eng 830	50	Electric Pow
X	X	X			Eng 830A	50	Electric Power I - Fundamentals
	S&W WR	X			Eng 830B	50	Electric Power II - Applications

Table 5. Continued

Service	Eng	New	Revise	Exist	Number	Hrs	Title
X	X			X	Eng 831	40	Plant Engineering
	X			Delete	Eng 832	50	Process Engineering
	X	X			Eng 832A	50	Process Engineering I
	FP&M	X			Eng 832B	50	Process Engineering II
	X			X	Eng 840	50	Farm Machinery Worksho
X	X		Change Number	X	Eng 841A	50	Tractor Servicing and Operation
	FP&M		Change Number	X	Eng 841B	50	Tractor Servicing and Operation
	X			X	Eng 842	40	Oxen and Small Equipment
	X			Delete	Eng 843	40	Farm Power I
	X	X			Eng 843A	50	Farm Power I - Small Engine Repair
	FP&M	X			Eng 843B	50	Farm Power II - Engine Electrical Systems
	FP&M	X			Eng 843C	50	Farm Power III - Testing and Trouble Shooting
	FP&M		Increase Hours	Title Change	Eng 844	50	Farm Power Trains
	X			Delete	Eng 845	50	Farm Machinery I
	FP&M	X			Eng 845A	50	Farm Machinery I
	FP&M	X			Eng 845B	50	Farm Machinery II
	FP&M				Eng 845C	60	Farm Machinery III
X	S&W WR				Eng 846	60	Farm Power and Machinery
	X	Old Number			Eng 847	50	Conservation Equipment

Table 5. Continued.

Service	Eng	New	Revise	Exist	Number	Hrs	Title
	FP&M		Increase hours		Eng 848	70	Farm Machinery Management
	FP&M	X			Eng 849	40	Hydraulic Systems
	X				Eng 850	50	Fluid Mechanics
	X	X			Eng 850A	50	Fluid Mechanics I - Fundamentals
	S&W WR	X			Eng 850B	50	Fluid Mechanics II - Hydraulics
	FP&M	X			Eng 851	50	Soil and Water Conservation
X	S&W WR		Increase hours		Eng 851A	60	Soil and Water Conservation - Utilization
X				X	Eng 851B	60	Surveying, Soil and Water Conservation
	S&W WR	X			Eng 851C	50	Soil and Water Engineering
X				X	Eng 852	50	Water Supply for Range Management
X	FP&M			X	Eng 853	50	Water Supply and Irrigation
	S&W			X	Eng 854	50	Water Supply and Sewerage
	S&W			X	Eng 855A	50	Overhead Irrigation
	S&W			X	Eng 855B	50	Surface Irrigation
	S&W WR	X			Eng 855C	30	Drainage
	S&W	X			Eng 856A	40	Field Experience I
	S&W	X			Eng 856B	40	Field Experience II
	S&W	X			Eng 856C	40	Field Experience III
	S&W	X			Eng 857A	10	Student Projects I

Table 5. Continued.

Service	Eng	New	Revise	Exist	Number	Hrs	Title
	S&W	X			Eng 857B	30	Student Projects II
	S&W	X			Eng 858	50	Land Use Planning
	X			X	Eng 860	40	Statics
	X			X	Eng 861	40	Strength of Materials
X			Number Change		Eng 862A	40	Farm Structures I
X			Number Change		Eng 862B	40	Farm Structures II
	X		Inc.Hrs. Add 864		Eng 863	60	Building Design Engineering
	X			Delete	Eng 864	50	Concrete Structures
	S&W WR	Old Number			Eng 864	40	Soil Mechanics
X				Delete	Eng 865	40	Farm Structures
	FP&M			X	Eng 871A	10	Student Projects I
	FP&M			X	Eng 871B	50	Student Projects II
	X			X	Eng 872	40	Outside Visits
	X		Reduce hours		Eng 874	20	Seminars
	FP&M	X			Eng 875A	40	Machinery Repair Practice I
	FP&M	X			Eng 875B	40	Machinery Repair Practice II
	FP&M				Eng 876A	40	Field Experience I
	FP&M				Eng 876B	40	Field Experience II

Table 5. Continued.

Service	Eng	New	Revise	Exist	Number	Hrs	Title
	FP&M		Number Change		Eng 876C	40	Field Experience III
	S&W WR	X			Eng 880	60	Hydrology and Meteorology
	S&W WR	X			Eng 881	50	Pumps and Pumping
	WR	X			Eng 882	50	Water Resource Systems
	WR	X			Eng 883	30	Water Resource Planning
	WR	X			Eng 884	50	Water Resource Supply
	WR	X			Eng 885	50	Dams and Spillways
	WR	X			Eng 886A	40	Field Experience I
	WR	X			Eng 886B	40	Field Experience II
	WR	X			Eng 886C	40	Field Experience III
	WR	X			Eng 887A	10	Student Projects I
	WR	X			Eng 887B	30	Student Projects II
	WR	X			Eng 888	30	Water Law and Government Policy

STAFF NEEDS

As indicated earlier, one of the critical needs of the Agricultural Engineering Department is additional staff.

Needs for Current Program

An immediate infusion of new staff is required to even maintain the current program. This need is urgent. At least three new lecturers, and an equal number of demonstrators are needed by the end of May 1978 if the program is to survive. The present staff simply cannot continue to carry the extremely heavy loads they are now doing. The morale of the staff is already low as is evidenced by the resignation of two lecturers this past year and the high turnover of demonstrators. The chief problem seems to be the work load. Staff are frustrated over lack of time to properly prepare for classes, give meaningful assignments, and to make proper evaluations.

The effects of inadequate staffing is also being felt by the students. A recent student publication talked about the "malnutrition' in the department and some students are considering changing majors.

The preceding statements are not made to be critical of the quality of staff presently on board. They are doing an excellent job given the circumstances under which they must operate. The statements are made to emphasize the urgency of getting new staff on board before the beginning of the new term at the end of May. In all probability, the new staff will need to be expatriate staff, as local advertisement does not bring in qualified candidates.

Needs for the Expanded Program

It is estimated that once the expanded program is in operation, a total of 23 lecturers and 38 demonstrators will be needed. To arrive at these figures, the estimated number of students who would require each class was listed. From this figure, the number of classes, both

lecture and practical, required to accommodate the students was determined. Then, using a maximum load factor of 10 lectures per week for 10 weeks per term, and 3 terms per year for one lecturer, and five 3-hour practicals per week for 10 weeks per term and 3 terms per year for one demonstrator the staff requirement for the department was determined. All of the above calculations and the resulting staff needs are given in Table III-1 of Appendix III. A summary of that table, with courses grouped in general subject matter groupings, is given in Table 6. The decimal fractions for each grouping have been rounded up in Table 6 to the next highest 1/2 man.

The load factor used in determining the staff needs is a heavy load. It will require complete concentration on teaching and will provide little time for professional development of the staff. In fact, it may lead to professional obsolescence simply because there would be insufficient time to keep up-to-date. A re-evaluation of the staff requirements led to the numbers in the "Recommended" column of Table 6.

It must be pointed out that the recommended number of staff is that number which will be able to handle the anticipated load once the program is fully developed and operational. Getting to that level will probably require additional staff, particularly until an adequate number of demonstrators can be identified and trained.

Expatriate Staff

One of the major reasons for a shortage of staff is that there are simply too few qualified Kenyans available. Those who are qualified do not want to work at Egerton because of high work load, lack of opportunity for professional development, or because they can get higher pay elsewhere. The recent coming of large corporate farms into the country, and recent added emphasis on rural development within the country, has created a high demand for personnel of the calibre required by the college, hence they are not available to fill the current vacancies. It is therefore evident, that until a sufficient number of Kenyans can be trained, most of the staff positions will have to be filled by expatriate staff.

Table 6. Summary of Staff Requirements for the Expanded Agricultural Engineering Program.

Subject Area	Minimum		Recommended	
	Lecturer	Demonstrator	Lecturer	Demonstrator
Statistics	1	1	1.5	1.5
Physics Mechanics Thermodynamics Mathematics	1	1	1.5	1.5
Drawing	1.5	1	2	2
Surveying	1	1.5	1.5	2
Welding and Workshop	1	4.5	2	5
Electric Power	.5	1	[1.5]	1.5
Processing	.5	1		1.5
Farm Power	1.5	6	2	6
Farm Machinery	2	4.5	3	6
Fluid Mechanics	.5	1	1	1.5
Soil and Water	2	4	3	3.5
Structures and Soil Mechanics	1.5	3.5	2	3.5
Water Resources	1	1	2	2
Totals	15	31	23	38

Since Lecturer ranks at Egerton College are similar to the professorial ranks at American Colleges, it is therefore recommended that the lecturers have a minimum of a M.S. degree in their respective fields. They may be recruited from the ranks of professional engineers, universities, vocational technical colleges, and private industry. It is especially important that those who are recruited have a "practical" orientation to their subject matter. One of the great needs of Kenya is a cadre of well qualified people who can do the things they know, hence a "show how," not just a "tell how," teaching ability is required.

Expatriate demonstrators can well be recruited from the rank of vocational and technical colleges, industrial machine shops, soil conservation service, and private industry. They should be men who have a wide experience in their specialized field and who teach by showing the required skills.

TRAINING NEEDS

The interests of Egerton College and Kenya would best be served if the college could be staffed by Kenyans. However, since Kenyan staff are not now available, it is essential that a concentrated training program be started which will eventually return enough well trained Kenyans to the country to fill the staffing needs.

The University of Nairobi has recently started a degree program in Agricultural Engineering. Its first group of students are now completing their second of a three year program. Graduates of this program will eventually help supply the need. Until then, it will be necessary to send Kenyans abroad for their education.

In order to meet the staffing needs at Egerton, it is recommended that a minimum of 5 potential lecturers and 5 potential demonstrators be sent abroad each year for at least the next 5 years. The lecturers should be sent to universities offering professional engineering degrees. A master degree should be the goal of the educational effort.

If possible, one year of field experience abroad after graduation should be part of the program.

Demonstrators should attend vocational schools where the emphasis of their training will be practical. The "hands-on" experience must be an essential part of their work. Here again, one year of field experience after graduation should be part of the training program.

It must be recognized and accepted, that not all of the trainees will stay at Egerton when they return. In a country where well qualified men are in demand at every level of the economy, piracy of the trainees can be expected. Therefore, the long-range training program should expect to train double or triple the number of people actually needed.

NEEDS FOR NEW PHYSICAL FACILITIES

To implement the new expanded program, new instructional space will be required. It is recognized that a team of architects, sponsored by USAID, is currently working with Egerton College on expansion needs of the entire college, including the needs of the Agricultural Engineering department. Therefore, only a brief summary of the specific departmental building needs will be given. Details will come from the other report. Specific dimensions of some of the buildings and labs will be given. Where cited, the dimensions will be those suggested by Egerton College Staff.

Classrooms:

1. One theater type classroom for 250 students on lower campus for use by all departments, 3500 sq.ft.

2. One classroom for 30 students, close to workshops but away from noise for blackboard instruction during practicals, 700 sq.ft.

3. One classroom for 30-40 students, with steep sloping seats and with enough room at front for demonstration of machinery and equipment, 1156 sq.ft.

4. One open shed in Field 5 to provide student protection on hot and rainy days, during field instruction for all machinery courses, 2000 sq.ft.

Water Resources Lab

Lab of sufficient size to contain

1. A long sump 125' X 6' X 6'

2. A recirculating glass-walled flume (see equipment section for dimensions)

3. 10 pump stations

4. Work space for 15 students per practical section.

5. Storage cabinets for student projects, sufficient for student needs of each term (may be more than one practical section per term). Equipment to be stored includes:

   a. electric motors

   b. internal combustion engines

   c. pumps used in repair projects - one for each pump - 24 total

   d. assorted coupling systems for pump connections

   e. other hydraulic testing equipment associated with the lab

6. Suction exhaust system to accommodate the engines

7. Office space for lecturers and demonstrators.

Soil Mechanics Structures Lab

A lab 30 ft. by 40 ft. plus office space for four persons. Will house the soil mechanics and structural testing equipment and be used for student experiments.

Workshops

1. Enlarge woodworking and metal working shops to 175% of existing space. This will add 1300 sq.ft. to each shop.

2. Separate the welding and forging work areas.

3. Install suction fans for exhaust system in the welding area.

4. Install suction fans with centrifugal separators for dust control on the equipment in the woodworking shop.

5. Install a manifold system for the gas welding area.

6. Construct a larger tool and supply store to increase the storage space to 250 sq.ft.

7. Divide the present store into office for farm power demonstrators.

Miscellaneous Facilities

Office space needed in the total plant for:

1. 23 offices of 100 sq.ft. for lecturers
2. 19 offices of 150 sq.ft. each for 2 demonstrators.
3. Office for two copy typists.
4. Adequate toilet facilities for men and women, staff and students, located near offices, workshops and class rooms.
5. Replacement and additional tractor and machinery sheds, cantilever type.

EQUIPMENT NEEDS

The proposed program of the Agricultural Engineering Department concentrates heavily on "hands on" practical experiences. The operation of such a program requires equipment, a lot of it, and some of it expensive. This was duly considered in the preparation of equipment lists and the recommendations made are regarded as justifiable. However, a few words of explanation regarding some possibly controversial requests may be in order.

Requests have been made for twenty-four tractors of various sizes and makes. The D 6 (or equivalent) Caterpillar and other specialized tractors are for specialized courses in heavy equipment operation and maintenance. Operation and maintenance of heavy equipment has been identified as a major problem in Kenya. Since the Engineering graduates from Egerton are often placed in positions to supervise heavy equipment operations, it is considered essential that they have some feel for the operation and maintenance of such equipment.

Currently, most of the students at the college are taught how to drive tractors by the Agricultural Engineering Department. When the expansion is complete, this will mean that 450 to 500 students each year must be taught to drive tractors. If each student has the

opportunity to drive for one hour per week, four tractors operating eight hours per day, five days per week, ten weeks per term and three terms per year would be required. Since such continuous operation is not possible, and since tractors used in teaching are subjected to excessive wear, more tractors must be used and be continuously available for class use. Furthermore, there will be certain times of the day when students will not be able to use the tractors because of conflicting time schedules. These problems, added to the fact that tractors must be available for other classes, makes the tractor request legitimate if the tractor driving program is to be maintained.

Another possible controversial request will be the number of tool kits requested. One of the essential components of the training program is proper care of hand tools. It is anticipated that each course requiring hand tools will have enough tool kits to meet the needs of that class. Thus, at the beginning of each term a student, or pair of students, can check out a kit for which he will be responsible during the entire term. Thus, he is more apt to take care of the tools, and if any are missing or broken, there will be no question of responsibility.

Similar justification can be made for the other requests.

Farm Power and Machinery Equipment

No. Required	Item
General Needs	
1	Electrical test stand for gasoline engines
1	Distributor Test stand for testing and adjustment of the distributor.
1	Generator and alternator test stand
1	Injection pump tester - dust-free room to be constructed
1	Heavy duty trailed disk harrow hydraulically lifted for 80 HP tractor
1	Gyro mower
1	Small motor grader
1	Earth moving scraper, 2 to 4 cu.yd. capacity
1	Self-propelled combine with an 8 ft. cutter bar and a corn harvesting head

No. Required	Item

General Needs (Cont.)

1	Pitmanless reciprocating mower
1	Disk tiller (6 ft. wide)
1	MF 2-furrow disc plow with 3rd bottom extension
2	Kvernelands 3 bottom plows, 12 inch width of cut
1	Mulcher: 2 rollers with a cultivator in between
1	Baler
1	Heavy tined cultivator
1	High pressure water washer 5 gpm, working pressure 300 psi with accessories
2	Grease gun fillers to fit 5 gallon pail
10	Hand pumped grease guns with filler attachment
8	Gas heaters for sodering irons
4	Blow torches, gasoline, 1-litre cap
10	English - metric 100 ft. - 30 meter steel tapes
20	Steel zigzag folding rules, metric 2 m.
20	Tool kits for general use - each containing

No.	Item
1	12" crescent wrench
1	16 oz ball peen hammers
1	5/16 - 6" screwdrivers
1	6" slip joint plier
1	cold chisel 1/2"
1	1/4" drift punch
1	set combination wrenches 1/4" - 1 1/4"
1	set box end wrenches 1/4" - 1 1/4"
1	set combination wrenches 6 mm - 34 mm
1	set box end wrenches 6 mm - 34 mm

Tractors for Machine Operation

3	80 HP tractor different makes but available in Kenya
5	70 HP tractor different makes but available in Kenya
5	60 HP tractor different makes but available in Kenya
2	45 HP tractor different makes but available in Kenya
6	30-45 HP tractor for tractor driving. Different makes but available in Kenya
1	4-wheel drive tractor, unequal wheel, 60-70 HP
1	4-wheel drive tractor, equal wheel, 15-20 HP with 3-point hitch and draft control
1	Crawler tractor (D6) with bulldozer blade, ripper, terracer, and subsoiler, all hydraulically controlled
1	4-wheel drive, equal wheel, 150 HP

No. Required	Item

Specific Needs for Specific Courses

840 and 875B

1	One-ton fork lift to raise to 12', lowered height 7.5', pneumatic tires, for storing equipment students are working on, in racks.

841

2	Super 8mm film loops projectors with build in screen and sound for infield use
1	Super 8 mm film loop projector with sound

842

4	Swing plows with 16 new shear points and 2 mouldboards
2	Self steering plows with 10 shear points and one mouldboard
2	Rotary hoes
3	Multicultivators
2	pairs oxen

843A, B, and C

4	telescoping gage sets, 0 to 100 mm
2	Telescoping gage sets, 0 to 150 mm
5	Micrometers, 0 to 25 mm
5	Micrometers, 25 to 50 mm
5	Micrometers, 50 to 75 mm
5	Micrometers, 75 to 100 mm
2	Micrometers, 100 to 125 mm
2	Micrometers, 125 to 150 mm

843 A

10	1 cylinder gasoline engines - Briggs & Stratton - 1-5 HP
10	1 cylinder diesel engines - Lister - 1-5 HP
1	Dynamometer - 1-5 HP
5	Valve Grinders
10	Briggs and Stratton overhaul kits
2	Compression Testers
1	Bearing Press
2	Gear Pullers
2	Fly wheel pullers
5	Valve seat grinder (sets) - both diesel and gasoline to match engines
10	Handtool box kits with lift-out tray, lockable - 1 for each 2 students, each containing
	1 Ball Peen Hamer - 16 oz
	1 Socket set - 3/8" drive - 1/4" to 3/4" - American fractional
	1 Box-end wrench set 1/4 to 1" - American fractional
	1 Carburation tool set

Specific Needs for Specific Courses (Cont.)

	1	Ignition tool set
	1	Slip joint pliers - 8"
	2	Crescent wrenches - 6" and 10"
	2	Chisels
	1	Allen wrench set - 5/64" to 3/8"
20		Storage bins - lockable - one for each engine and a tool kit

843 B

15		Tool kits with following tools
	1	1/8" by 4" screwdriver
	1	3/16" by 4" screwdriver
	1	1/4 by 6" screwdriver
	1	5/16 by 6" screwdriver
	2	Phillips screwdrivers
	1	wire striper
	1	slip joint pliers
	1	electricians knife
	1	long nose pliers
	1	4" crescent wrench
	1	6" crescent wrench
	1	Set 1/4" - 3/4" combination spanners
15		Automotive electrical wiring boards with lockable cabinets to store them in. Each board should contain:
	1	1 1/4" x 4' x 4' Aluminum sheet for mounting board
	2	head lights
	1	dimming switch
	1	fuse holder - 10 fuses
	2	amber turn signals lights
	2	red turn signal lights
	1	turn signal switch for independent bulbs
	1	head light and parking light switch
	2	parking lights
	1	horn
	1	horn button
	1	horn relay
	2	brake and tail lights
	1	brake light switch
	1	oil pressure switch
	1	oil pressure light
	1	generator light
	1	ignition switch

843 B and C

1	Complete electrical test stand for engine
1	Distributor test stand
1	Generator and alternator test stand
1	Injection pump tester and dust free room
2	Ignition coil testers
2	Condenser testers
2	Cylinder leakage testers
6	Small 4 cylinder gasoline engines with parts available in Kenya, set up on stands
6	Extra distributors for above

Specific Needs for Specific Courses (Cont.)

1	Bank of 4 spool valves with pressure relief built in
	1 decent both directions
	1 spring return both directions
	1 decent - spring return
	1 float
1	Relief valve
8	Female quick connects
8	Hoses with male and female quick connects, one on each end
	4 3' hoses
	4 6' hoses

Soil and Water and Water Resources Equipment

General Needs

1	Borehole with (a) Equipment to study draw down, yield, etc. (b) submersible pump, (c) pipe
1	Submersible pump, cutaway
2	Power heads
2	Diesel motors for powerheads
1	Velocity measuring equipment
1	Dry well near water laboratory
1	Water filter for water
1	Water stage recorder
	Materials to construct wiers
2	Centrifugal pumps with electric motors
2	Propeller pumps - one with electric motor and one with diesel engine
2	Turbine pumps - one with electric motor and one with diesel motor
	Assortment of pullies and belts
1	Watt-hour meter
1	Hydraulic pump for a dynometer
1	R.P.M. Gauge
2	Scales
5	Pressure gages - 0-30 psi
5	Pressure gages - 0-150 spi
5	Vacuum gages
5	Viscosimeters - various types
3	Pumps - centrifugal - 400 gpm capabity each
3	Manometers
3	Pipe tool sets
2 ea.	Flowmeters - orifice; venturi; elbow; screw and pitot tube
1	Floor sump - 125' x 6' x 6' - 4500 cu.ft. capacity
10	Pump stations along sump - equipped for electric motor or gasoline engine
10	Pump mounting stands
1	Glass walled flume - for flow phenomenon studies
	- 2' x 2' x 50'
	- tilting bed
2	Platform scales with weighing tanks for water measuremen
2	Gurley flow meters - magnetic pick up heads - readout meters

Specific Needs for Specific Courses

881

Pumps - to be used for student overhaul experience
4 Hand
4 Centrifugal
4 Turbine
4 Submersible
4 Windmill (piston)
4 Jet
4 Hydraulic ram
1 Fuel measuring device
4 Watt meters
1 Voltmeter
1 Ammeter
2 Electric motors to match pumps
2 Gasoline engines to match pumpts

882 and 884

1 Sand filter
1 Chlorinator
Plumbing supplies for student practice
--valves - float; pressure regulating, globe; gate; foot; flap; anti surge; vacuum breakers
--Water outlet taps
--Steel and plastic pipe fittings - T's; L's; unions; crosses; nipples; etc.
--galvanized pipe
--plastic pipe
Plumbing tools
--Pipe cutters - hand and power
--Reamers - hand and power
--Threaders - hand and power
--Hack saws - hand and power
--Wrenches (12", 15", 18")
1 Totalizing flow meter
1 Trencher
Surveying equipment - 5 complete sets to be kept separate from surveying equipment used to teach surveying to beginning students. Each set should include:
1 Level and tripod (level should have a horizontal degree scale)
1 level rods - metric
1 surveying chain - metric
1 hatchet
1 hand level
4 range poles

Equipment for Support Courses

Electric Power

1	1 HP AC-DC Generator (or 1 each)
10	Transformers - variable output - 0 to 240 volts
3	Wire resistance panels
15	Voltmeters - bench - 0 to 300 volts
15	Ammeters - bench - 0 to 30 amps
15	Wattmeters - bench - 0 to 5 KW
15	Ohmmeters - bench - 0 to 10,000 ohms (may be staged)
5	Combination meters (portable)
15	Wire size gages
5	Soldering guns
	Wiring supplies

--switches
--fuse boxes and fuses
--circuit breakers
--plugs
--light sockets
--conduit and connectors
--solder
--outlet boxes
--lamps
--thermostats
--immersion heaters
--heating coils
--toggle switches

	Tape
	Screws, nails, staples
1	5 hp dynamometer for electric motors
15	Hand tool kits - to include

--hammer
--pliers - roundnose
- needlenose
--screwdrivers - 2 sizes
--wire cutters
--insulation stripper

Electric Motors -

	1/4 to 1/2 HP, to be used by students for cleaning, maintenance and repair
4	DC
4	AC - split phase
4	AC - capacitor start
4	AC - series wound
4	Engine driven - AC Generators for submersible pumps
	Copper magnet wire
	Motor Starters
	Motor control boxes
	Overload protective devices
	Storage bins for student projects

Soil Mechanics

1	Humidifier
1	Desicator
1	Brass fittings
200'	Tubing - plastic
50'	Flexible tubing (copper)
50'	Saran tubing

Soil Mechanics (cont.)

10 doz	Moisture boxes
12	Graduated cylinder
5	Platform scale
5	Mortor
5	Pestle
15	Spatulas
1	Wire saw
6	Mixing pans
3	Calipers
24	Beakers
4	Mixing pans
1	Oven
6	Thermometers
1	Sample splitter
1	Air compressor
15	Evaporation dishes
1	Soil sampling kit
4	Blade auger
1	Mettler Precision Balance Model K-7T

Equipment for Specific Tests

Atterberg Limits

4	Liquid limit device
4	Plastic limit plates

Specific Gravity

6	Bottles
4	Aspirator

Compaction

4	Compaction mold
3	Standard hammer
3	Mod. hammer
2	Penetrometer
4	Mixing pans

Permeability

2	Comp. permeameter
2	Permeameter

Size Determination

23	Sieves
3	Pan
3	Cover
1	Shaker
1	Stirrer
2	Solution
3	Hydrometer
1	Jars
1	Solution
1	Brush

Soil Mechanics (Cont.)

Equipment for Specific Tests

Tri-axial Test

1	Tri-axial apparatus
1 doz	Membranes
1	Jacket
1	Mold

Unconfined Compression

1	Test apparatus

Consolidation

1	Consolidation test
1	Trimmer

Field Density

1	Field Density set

Farm Structures and Materials Testing

1	Electric concrete mixer
	Humidity cabinet
	Compacting tractor apparatus (complete)
	Compression testing machine
	Standard vibrating machine
	Vebe consistometer (complete)
	Flexural and transverse machine (for beams, etc.)
	Cube moulds
	Beam moulds
	Cement and mortar moulding cubes
	Concrete test hammer
	Pachometer
	Air meter
	Compacting factor apparatus
	Sieve analysis machine
	Concrete masonry saw
	Drying oven
	Flakiness sieves
	Timing clock
	Semi-automatic balance
	Riffle boxes (for sampling)
	Permeability (apparatus/complete)

Wood and Metal Shops

	Manifold system for oxygen and acetylene
	Power feed reciprocating hacksaw
12	Gas soldering coppers
10	Large anvils
2	Round 3-foot stationary forges with overhead hood
1	Spot welder for Bandsaw blades
1	300 amp. DC Generator welder electric drive 80% duty cycle
1	200 amp. DC Generator welder tractor PTO driven, 40% duty cycle
1	250 amp. Tig heliarc welder
1	250 amp. Mig heliarc welder

Wood and Metal Shops (Continued)

1	Forced ventilation system for welding lab
1	Centrifugal sawdust and shaving collection system for wood shop
1	Metalizing gun (wire rod) for building up worn parts
1	Angle iron Notcher and Bender 90°
1	Angle iron rolls
1	Pipe bender
5	8" x 3' Bench lathes (engine lathes)
3	3' wood lathes
8	5" metal vices
1	Electric wood shaper
1	8" jointer
1	Heavy duty saker saw
1	Heavy duty portable power hand plane 12"
1	Heavy duty portable power hand plane 18"
1	Mortiser machine
1	Heavy duty 14" table saw
1	Heavy duty 10" circular hand saw
1	Electric chainsaw 18" blade
1	Paint spray booth with ventilation 12' x 18'
10	8" wood vices
2	Bench drill presses
1	Metal shear 6" jaws
1	10' bench guider
2	Rockwell hardness testers
1 doz	18" tongs-round nosed (curve lip)
1 doz	18" tongs-flat nosed (straight lip)
1 doz	18" tongs - square nozed
1 doz	18" tongs - single pickup
1 doz	18" tongs - double pickup
1 doz	18" tongs - rivet
1/2 doz	flatter
1/2 doz	set hammer
1 doz	hardy
4 sets	assorted sizes hot chisels
4 doz	assorted sizes cold chisels
4 doz	assorted sizes square punches
4 doz	assorted sizes round punch
4 doz	assorted sizes fullers (set - top and bottom)
1	Swage block
1 doz	assorted swages (set - top and bottom)
1 doz	heavy duty electric soldering guns
1	Dividing head for teaching purposes.

Surveying Equipment

10	Dumpey levels and tripods
10	Level rods - metric
10	30-meter steel tapes
10	Hand levels

Tool Stores

2	Sets socket wrenches metric 6-40 mm
2	Sets open end wrenches 6-40 mm

Tool Stores (cont.)

2
2
2
20

Maintenance Shop

1	14" shaper
1	Horizontal mill with vertical attachment
1	Surface grinder
1	Set broaches
1	Arbor press plain lever type to use with broaches above
1	Set in line reamers
1	Lathe grinder attachment

ansportation for Department

For spares procurement, outreach programs and staff and students movement to and from fields

1	3/4 ton pickup
2	VW Kombie type vehicle
2	Landrovers for on College movement and in fields

PROGRAM PHASE-IN

It is anticipated that a minimum of 5 years will be required to get the new program into full operation. Programs, students, facilities and staff should be added in stages. The existing Farm Machinery-Farm Power stream with 30 new students per year should be continued for 3 more years. At that time, the Soil and Water Conservation stream should be added with 30 additional new students each year. Five years hence the final stream, Water Resources Development, should be added with its 30 new students, making a total of 90 new students per year or a total of 270 students in the program at any one time. This phase-in of the new streams is summarized in Figure 1.

During this phase-in period, it will be necessary to do all of the construction work. Construction should begin with improvement of the existing water resources lab during the first year. Then as soon as possible, certainly within the first six months of the 1978-79 school

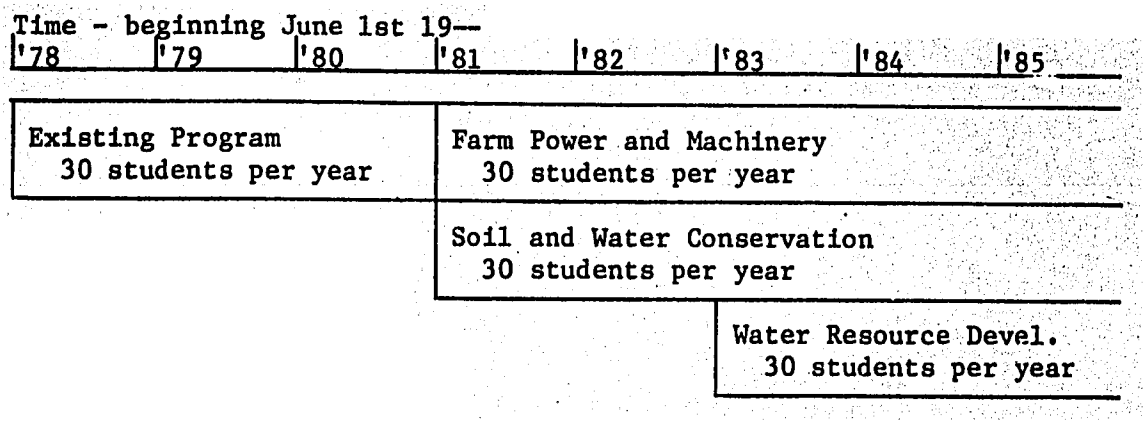

Figure 1. Phase-in of New Curriculum in the Agricultural Engineering Department.

year, expansion and remodeling of the farm power and machinery shops, the support shops, and the field shed should be started. Completion date for this phase should be May of 1980. About mid-year of the 1979-80 school year, construction should begin on the new auditorium, classrooms, and associated offices. Completion should be sometime during the 1981-82 school year. The last construction phase, construction of the Water Resource, Structures-Soil Mechanics Labs, and the remaining offices, should be started in the 1981-82 school year and be completed by May of 1983. These facilities should all be equipped as they are completed. Figure 2 summarizes the phasing of the construction program.

Timing of adding new staff is critical. The chart in Figure 3 shows the latest date that all staff should be on board. This is perhaps the most critical part of the phase-in program. If the staff are on hand, the program can go forward, even if on a make-shift basis,

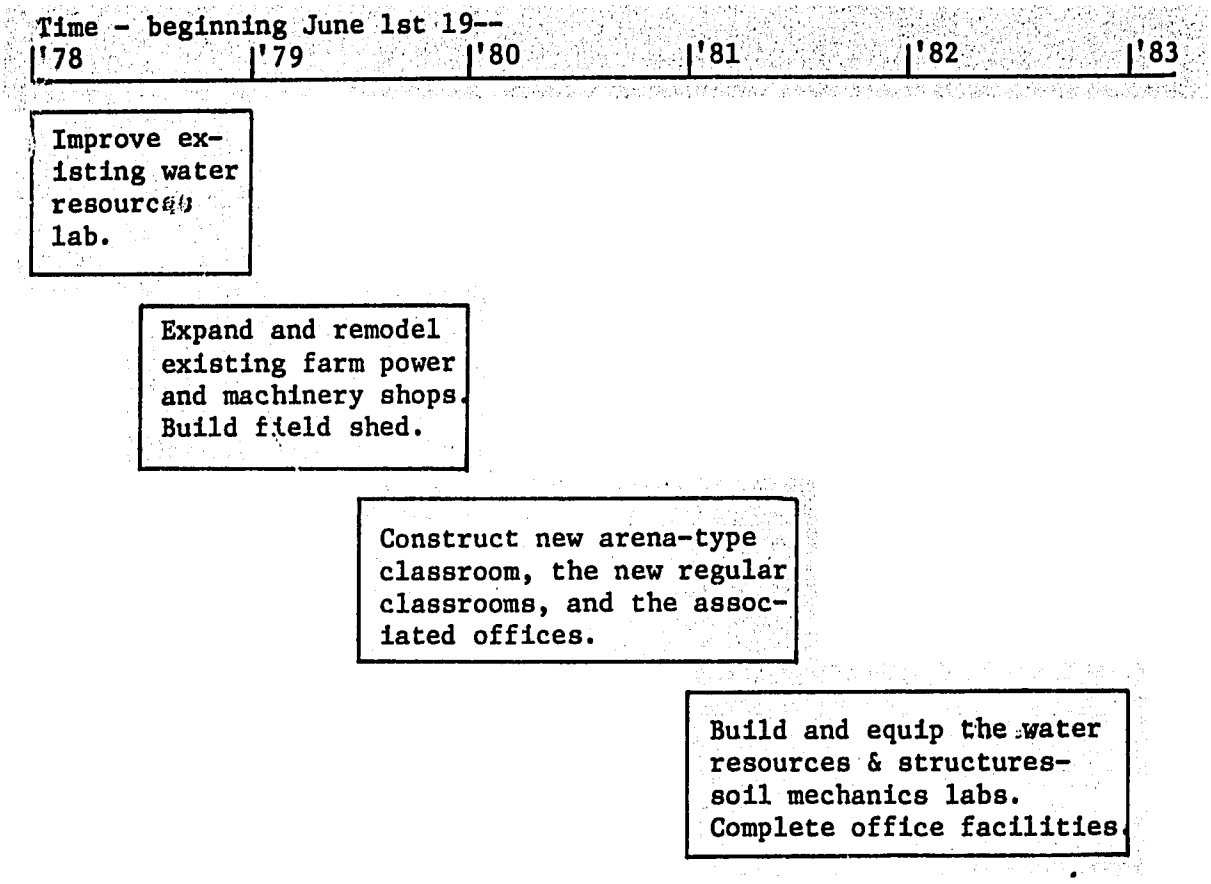

Figure 2. Construction timetable for the Agricultural Engineering Department.

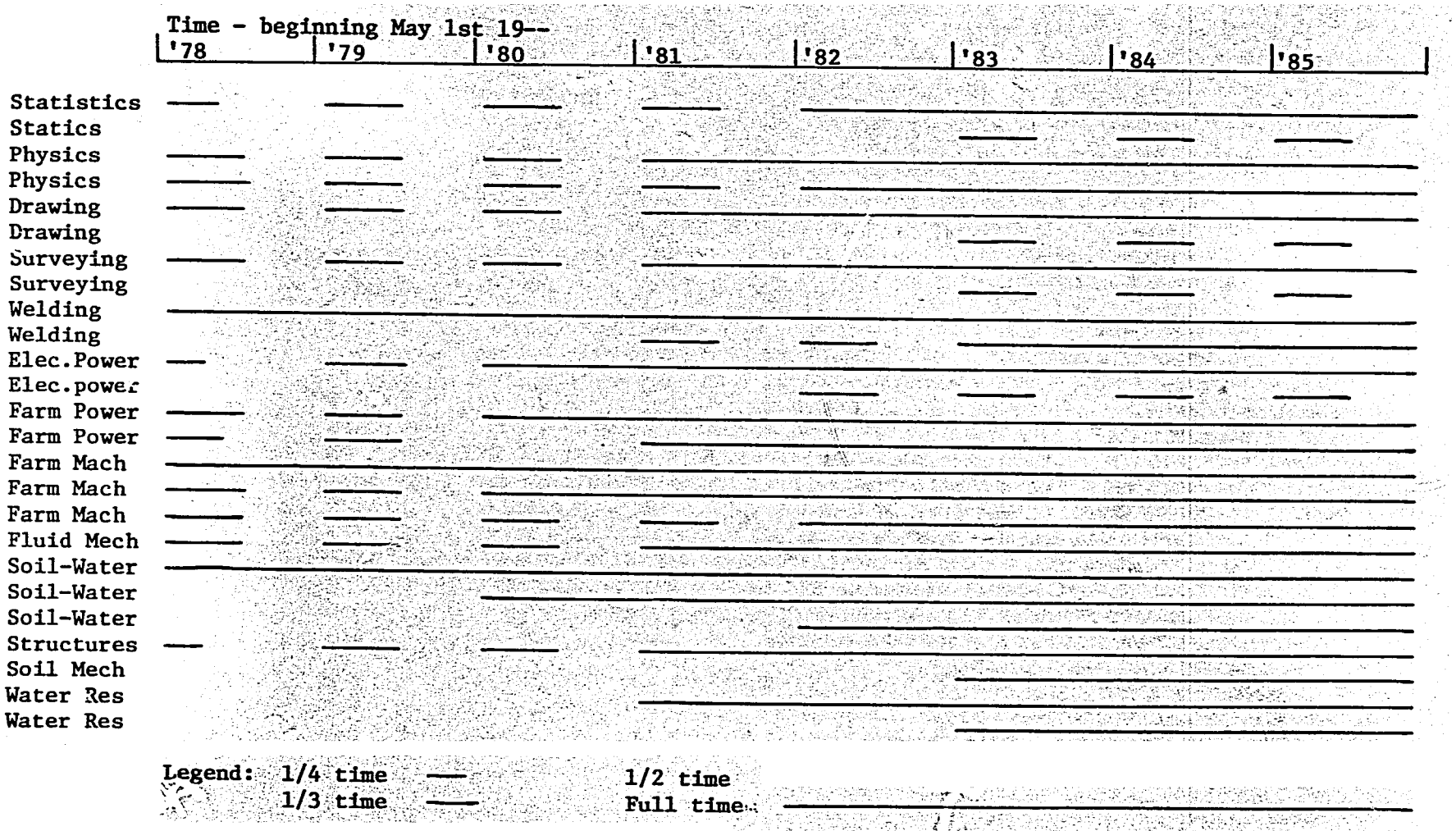

Figure 3. Staff requirements for the Agricultural Engineering Department.

until the facilities are completed. However, even the finest of facilities will be idle if adequate staff are not available. Figure 4 summarizes the year by year staff requirements. Both Figures 3 and 4 are for the lecturers only. Demonstrators must be added at a proportional rate.

Phase-in of equipment should be parallel to the construction of the facilities and to the program update. However, the need for tractors is critical. Five new tractors should be added each year for the next 5 years, and then 2 tractors should be replaced each year every year thereafter.

ALLOWANCE FOR TEXTBOOKS

It is the current policy at Egerton to maintain a textbook pool for the textbocks used in its courses. At the beginning of a term, a student checks out a text, uses it for the term, and then checks it back in at the end. Thus he is not required to buy textbooks. At graduation time, he is given a modest allowance to buy one or two texts from the pool. Thus, when he leaves the college, the only reference material he takes with him are the notes he has taken in class and the one or two texts he is able to buy. This is NOT ENOUGH. It is impossible for an instructor to adequately present all the reference material needed in a course in such a manner that a student can get it into his notes, i.e., friction factors for pipe line and open channel flow design. Furthermore, it is impossible for a student to decide which of all the new material presented to him he is going to need, or isn't going to need in his professional career, and equally impossible for him to get all the professor says into his notes. Every reputable engineer in the world has a personal library at his command filled with reference material he can use at a moment's notice. This library usually begins with his College textbooks. It is, therefore, strongly recommended that the student be given, or required to buy, EVERY textbook he uses in his PROFESSIONAL courses. Thus, when he graduates, he will take with him a vast storehouse of useful information which he can turn to at will to strengthen him in his work. It seems almost superfluous to

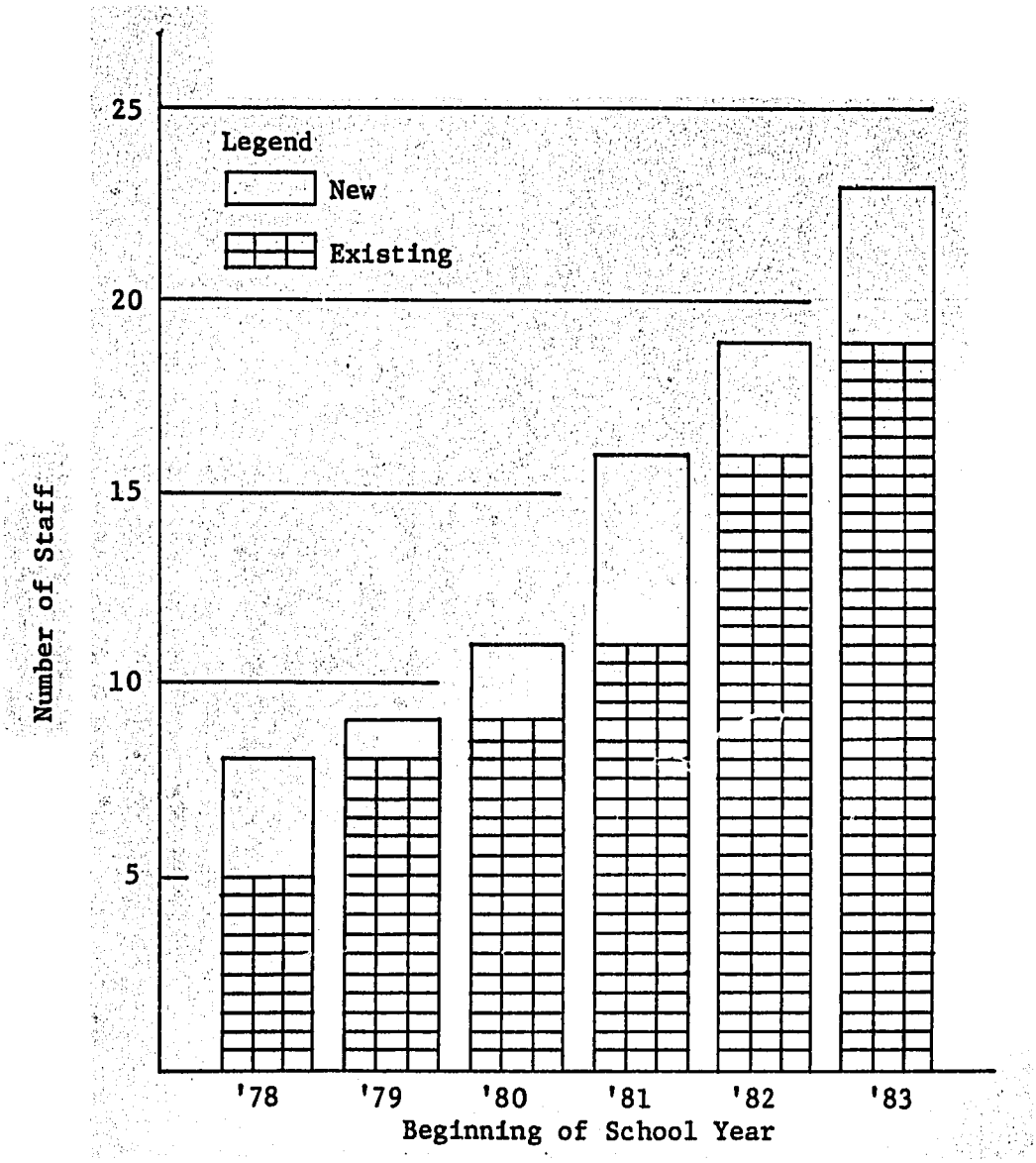

Figure 4. Summary chart of the staff requirements for the Agricultural Engineering Department

send him to school for three years, pay his tuition and fees, give him his room and board, award him a modest living allowance, and then deny him the extra Ksh.7,000 to Ksh.10,000 that would be needed to provide him with his professional texts. He MUST have his texts when he leaves.

SUMMARY

It is the desire of Egerton College and various action Ministeries of the Kenyan Government that the Agricultural Engineering program at the College be expanded and specialized to more adequately meet the professional needs of the country. The expansion of the program will be into three major streams, Farm Power and Machinery, Soil and Water Conservation, and Water Resources Development. Each of the three streams will have 30 students per year which means that at any time, there will be about 270 students in the department. Students from other departments will also be taking some of the Agricultural Engineering courses.

To meet this expansion, indeed to maintain the present program, will require additional staff. The expanded program will require at least a 4-fold increase in personnel. Since this number of staff are not available within the Country, expatriate staff will be needed.

The lack of adequately trained staff within the country emphasizes the need for an intensive expatriate training program for Kenyans. The program must be directed towards getting Kenyans into foreign universities and training centers where they can acquire the needed skills, and then get them back into the Kenyan educational system. Since there is such a demand within the country for people with the same skills as those required at Egerton, piracy of the trainees by other organizations can be expected. Thus it may be necessary to train as many as 2 or 3 people for every one that is needed at the College.

The increase in enrollment and staff brought about by the expansion will require a corresponding increase in buildings and equipment. New

classrooms and laboratories will need to be built and equipped; new office space must be provided for the staff; and new supply and support facilities provided.

With the addition of these facilities and staff, the Agricultural Engineering department at Egerton College will be able to produce well trained men who can begin to fill the void of farm power and machinery, soil and water conservation and water resource specialists which now exists within the country.

APPENDIX I

Existing Course Schedules

1. Course schedule for diploma in Agricultural Engineering
2. Catalogue description of all courses taken by the Agricultural Engineering Student and all courses taught by the Agricultural Engineering staff.
3. Field attachment

DIPLOMA IN AGRICULTURAL ENGINEERING

First Year

Term I.		10 Weeks	
HOMEC	032	20 hrs	P.B.F.L.
BIO	211	60 hrs	Agricultural Botany
CHEM	313	40 hrs	Chemistry for Engineers
ECON	611	20 hrs	Price Theory and Market Formation
EDUC	711	30 hrs	Introduction to Language Communication
ENGIN	817	50 hrs	Mathematics
ENGIN	825	60 hrs	Workshop
ENGIN	841	50 hrs	Tractor Servicing and Operation
		330 hrs	33 hrs per week

Term II.		10 Weeks	
BIO	214	20 hrs	Ecology
CHEM	322	60 hrs	Soil Physics
ENGIN	813A	40 hrs	Mechanics
ENGIN	815	40 hrs	Drawing I
ENGIN	820	40 hrs	Welding Practice
ENGIN	840	50 hrs	Farm Machinery Workshop
ENGIN	841	40 hrs	Tractor Servicing and Operation
		290 hrs	29 hrs per week

Term III.		10 Weeks	
HOMEC	041	20 hrs	Human Nutrition
ECON	613	30 hrs	Production Economics
ENGIN	813B	50 hrs	Elementary Thermodynamics & Electricity
ENGIN	716	40 hrs	Drawing II
ENGIN	826	40 hrs	Power Shop Equipment
ENGIN	842	40 hrs	Oxen and Small Equipment
ENGIN	845	50 hrs	Farm Machinery I
ENGIN	860	40 hrs	Statistics
		310 hrs =	31 hrs per week

APRIL - MAY: Field Attachment (See Appendix I)

Second Year

Term I.		10 Weeks		
CHEM	321	60 hrs		Soil and Fertilizer Chemistry
CROPS	412B	30 hrs		Principles of Crop Production
ECON	631	30 hrs		Farm Records and Accounts
ENGIN	818	50 hrs		Survey I
ENGIN	843	60 hrs		Farm Power I
ENGIN	848	50 hrs		Farm Machinery Management
ENGIN	861	40 hrs		Strength of Materials
		320 hrs	=	32 hrs per week

Term II.		10 Weeks		
ANSCI	128	40 hrs		Principles of Animal Production
CROPS	421	30 hrs		Pastures and Fodder Crops
ENGIN	819	50 hrs		Surveying II
ENGIN	844	40 hrs		Farm Power II
ENGIN	847	50 hrs		Farm Machinery II
ENGIN	850	40 hrs		Fluid Mechanics
ENGIN	864	50 hrs		Concrete Structures
		300 hrs	=	30 hrs per week

Term III.		10 weeks		
CROPS	424	40 hrs		Annual and Perennial Crops
ECON	621	40 hrs		Farm Management
EDUC	712	20 hrs		Technical Report Writing
EDUC	751	30 hrs		Introduction to Rural Sociology
ENGIN	830	50 hrs		Electric Power
ENGIN	855A	50 hrs		Overhead Irrigation
ENGIN	854	50 hrs		Rural Water Supply and Sewerage
ENGIN	875	40 hrs		Field Experience
		320 hrs	=	32 hrs per week

APRIL - MAY: Field Attachment (See Appendix I)

Third Year

Term I.		10 Weeks		
ECON	612	20 hrs		Marketing Policies
EDUC	731B	60 hrs		Educational Technology II
EDUC	752	20 hrs		Principles of Extension Education
ENGIN	851A	50 hrs		Soil & Water Conservation
ENGIN	863	50 hrs		Building Design Engineering
ENGIN	871A	10 hrs		Students Projects
ENGIN	875	40 hrs		Field Experience
		250 hrs	=	25 hrs per week

Term II		10 Weeks		
ECON	614	30 hrs		Economic Development
ENGIN	831	40 hrs		Plant Engineering
ENGIN	832	50 hrs		Process Engineering
ENGIN	855B	50 hrs		Surface Irrigation
ENGIN	871B	30 hrs		Students' Projects
ENGIN	875	80 hrs		Field Experience
ENGIN	851C	50 hrs		Soil and Water Engineering
		330 hrs	=	33 hrs per week

Term III		5 Weeks		
EDUC	756	20 hrs		Government Procedure
ENGIN	872	40 hrs		Outside Visits
ENGIN	874	40 hrs		Seminars
		100 hrs	=	20 hrs per week

CATALOGUE DESCRIPTIONS OF

COURSES TAKEN BY AGRICULTURAL ENGINEERING STUDENTS

COURSES TAUGHT BY AGRICULTURAL ENGINEERING STAFF

Home Economics Department (0. . . .)

HOMEC 032: PLANNING FOR BETTER FAMILY LIVING

Responsibilities of marriage and parenthood; the biological, social, and economic aspects of family life; the processes involved in organization and reorganization of a family; different approaches to family planning; emphasis on the relation between family size and resources.

Lecture - 20 hrs; C.F. 2.
Y1 T1 - AG, AH, DT, ENG, FM, HORT, RM, HEC
Y3 T3 - EDUC

HOMEC 041: INTRODUCTION TO HUMAN NUTRITION

An introductory course to principles of human nutrition and world food problems with emphasis on East Africa; nutrients and their sources; this is to include: Energy requirements and metabolism, proteins, minerals and vitamins, their functions, sources and requirements in the diet; nutritional needs of family members with emphasis on malnutrition in children, its symptoms, cause and cure, different methods of assessment of nutritional status; introduction to the methods of assessment of nutritional status; causes of food poisoning; and budgeting for the family.

Lecture/Practical - 20 hrs; C.F. 2.
Y1 T3 - All streams except ED.

Animal Science Department (1 . . . .)

ANSCI 128: PRINCIPLES OF ANIMAL PRODUCTION

Lectures and practicals in various aspects of animal husbandry, disease control and management for Agricultural Engineering students.

Lecture/Practical - 20/20 hrs; C.F. 3.
Y2 T2 - ENG.

Biology Department (2 . . . .)

BIO 211: AGRICULTURAL BOTANY

A review of the Plant Kingdom; essentials of flowering plant taxonomy; origins of crop plants; anatomy and morphology of selected crops; floral biology; sexual reproduction and seed formation; the plant cell and its organelles; enzyme catalysis; carbohydrate metabolism, respiration and photosynthesis; the plant and water; mineral nutrition and nitrogen metabolism; the physiology of growth and development.

Lecture/Practical - 30/30 hrs; C.F. 4.
Y1 T1 - AG, FM, AH, RM, ENG, HEC, HORT, ED.

BIO 214: ECOLOGY

The principles of ecology; ecosystems, plant communities; food webs and trophic levels; energy flow; biogeochemical cycles; environmental factors; populations; succession; zones of ecological potential and physiognomic vegetation types in Kenya; land use in the different zones; applied ecology; conservation; pollution; the environmental crisis.

Lecture - 20 hrs; C.F. 2
Y1 T2 - AG, HORT, ED, HEC, ENG, RM.
Y1 T3 - AH, FM.

Chemistry Department (3 . . . .)

CHEM 311: PHYSICAL CHEMISTRY

Laws of chemical combinations; atomic and molecular theories; periodic classification of elements; chemical bonding; Solutions; Acidity and alkalinity; Electrolysis; Ionic theory; Redox reactions; Thermochemistry; Energy relations and kinetics of chemical reactions; the colloidal state; and Radioactivity.

Practical: Common analytical operations; the analytical balance; qualitative analysis of unknown chemical samples; volumetric analysis; acidimetry and alkalimetry; redox titrations; gravimetric analysis; instrumental methods.

Lecture/Practical - 20/20 hrs; C.F. 3
Y1 T1 - All Streams, except ENG.

CHEM 313: CHEMISTRY FOR ENGINEERS (METALLURGY)

The course will be taught jointly by Chemistry and Agricultural Engineering Departments. Chemistry department will handle the lectures while Agricultural Engineering department handles the practicals.

Lecture: Classification of materials; characteristics of metals--physical and mechanical properties; production of iron and steel; types of furnaces and the production process; chemical properties of iron; Alloys and special steels, solder, brass and bronze; heat treatment and surface treatment of steel; Combustion of fuel, rusting of iron; Hydrogen and water; coal, graphite and other forms of carbon, carbon dioxide Thermochemistry--Producer gas, carbon monoxide, fuel gas etc.; Chloride and its oxycompounds; Oxidation and reduction; Sulphur and its compounds; the ionic theory, electric cells; corrosion protection of metals; phosphorus, silicon, chromium, molybdenum, tungsten, manganese, nickel, cobalt and platinum as related to iron production and alloys.

Practical: Recognition of common metals; visual and spark test; shaping and forming operations--cold or hot; Bending operations; heat treatment of steel; case hardening; tempering, annealing, hardening normalizing, surface treatment: hard facing, plating, foundry metallurgy, pattern design and the castings; welding, soldering and brazing work.

Lecture/Practical - 20/20 hrs; C.F. 3
Y1 T1 - ENG.

CHEM 321: SOIL AND FERTILIZER CHEMISTR

Lecture: Soil colloids--clays and humus formation--factors affecting the levels of inorganic and organic colloids in soils; their role in cation exchange process and water holding capacities of soils; soil colloids and heat absorption and conduction; acidity and alkaline production in soils and methods of regulation; mineral and organic soils; plant nutrient release; their movement and retention in mineral and organic soils; sources of soil plant nutrients; soil fertility and fertilizers; fertilizer demand and classification; Manufacture and storage of fertilizer in soils and their selective use in different crops; soil micro-organisms and plant nutrient availability; nutrient fixation and methods of release; Manures in crop production; classification of manures; methods of preparation and storage; timing of manure application; nutrient and other physio-chemical value of manures.

Practical: Soil sample collection and preparation; soil fertility assessment including organic matter; cation exchange capacity; soil pH; lime, mineral nutrients; nitrogen forms; exchangeable bases and base saturation; sodium absorption ratio; fertilizer materials; straight and compound fertilizer; detailed analysis of nitrogen, phosphate, potassium, liming and organic materials; methods of interpreting experimental reports; methods of compounding fertilizers and quantitative assessment of constituent straight fertilizers.

Lecture/Practical - 30/30 hrs; C.F. 5
Y2 T1 - All Streams except DT and HEC
Y3 T1 - HEC

CHEM 322: SOIL PHYSICS

Lecture: Pedology and Edaphology; Scientific bases of soil study; meaning and origin of parent material with special reference to Kenya; minerals of the earth's crust important in soil formation; weathering process and agents; soil forming factors and processes; soil particle classification; soil structure and texture; factors affecting soil structure; soil water; liquid and gaseious losses of soil water and methods of control; factcrs influencing efficient water use by crops; soil air and temperature and factors promoting their movement in soils; significance of soil air and temperature in crop production.

Practical: Laboratory study of collected samples of rocks and minerals; methods of identification; laboratory methods of physical and chemical weathering; the role of rocks and minerals in soil formation and their plant nutrient potential. Soil Survey for fertility assessment and soil profile study; methods of collecting soil samples and laboratory handling; Methods of soil mechanical analysis and systems of soil particle classification; the textural triangle and textural classification of soils. Laboratory study of drainage and capillarity in soils; methods of assessing different types of soil water (or moisture); soil temperature study in the field; laboratory demonstration of gas production in soils; preparation of soil monoliths; soil consistence determinations.

Lecture/Practical - 30/30 hrs; C.F. 5
Y1 T2 - AH, ENG, RM
Y1 T3 - AG, HORT, FM, ED
Y2 T1 - HEC

Crop Production Department (4 . . . .)

*CROPS 412A: PRINCIPLES OF CROP PRODUCTION

Crop ecology; land preparation, weeds and weed control; planting, spacing, rotation, nursery, plant propagation, mulching, manuring, fertilizers, irrigation, pests and disease control, grain storage.

Lecture - 50 hrs; C.F. 5
Y1 T2 and Y1 T3 - AG, ED, HEC, FM, HORT

CROPS 412B: PRINCIPLES OF CROP PRODUCTION

As for 412A above.

Lecture - 30 hrs; C.F. 3
Y2 T1 - AH, ENG, RM

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*These courses are not required by the engineers but the description is necessary for the description of courses which are required by them.

CROPS 421: PASTURES AND FODDER CROPS

Pasture establishment management and conservation. Individual pasture and fodder species.

Lecture - 30 hrs; C.F. 3
Y2 T1 - AG, ED, FM
Y2 T2 - ENG, AH, RM
Y3 T1 - HEC

*CROPS 422: ANNUAL CROPS

Maize, Sorghum, millets, rice, wheat, barley, oats, cotton, tobacco, groundnuts, potatoes, beans, soya, sunflower, peas, simsim, linseed, grams.

Lecture - 50 hrs., C.F. 5
Y2 T2 - AG, ED, HORT, FM
Y3 T2 - HEC

*CROPS 423A: PERENNIAL CROPS

Coffee, Tea, pyrethurm, sugar-cane, bananas, sisal, cocoa, coconuts, passion fruit, cashew, pineapple, citrus, mango, macadamia nut, cassava, cloves, wattle.

CROPS 424: PERENNIAL AND ANNUAL CROPS

A condensed course covering CROPS 422 and CROPS 423A.

Lecture - 40 hrs; C.F. 4
Y2 T3 - ENGIN

Economics Department (6 . . . .)

*ECON 611: PRICE THEORY AND MARKET FORMATION

The organization of an economic system, demand, supply and market price under pure competition and the factors that affect them; individual consumer demand--the utility approach and the indifference curve approach. Market Classifications and the demand curve faced by the firm.

Lexture - 20 hrs; C.F. 2
Y1 T1 - All Streams.

*ECON 612: AGRICULTURAL MARKETING AND POLICIES

Agricultural marketing and its role in the development of agriculture; Marketing cooperatives and marketing boards with particular reference to East Africa; Government price control and marketing policies; introduction to international trade and international commodity agreements.

Lecture - 20 hrs; C.F. 2
Y3 T1 - All Streams

*ECON 613: PRODUCTION ECONOMICS

The meaning, purpose and importance of production; factors influencing production and factors of production; factor specialization and its implications for production; production function and the law of diminishing returns; total average and marginal costs; cost minimization and revenue maximization; factor combinations; returns to scale; economics of scale and economic efficiency on the farm; risk and uncertainty and their influence on production; production over time; time and interest; discounting and compounding procedures.

Lecture - 30 hrs; C.F. 3
Y1 T2 - FM
Y1 T3 - All Streams except FM.

*ECON 614: ECONOMIC DEVELOPMENT

The meaning, importance, benefits and costs of economic development; important measures of economic development; factors influencing economic development: Land: Land tenure and land reforms; capital; savings investment and economic growth; the role of consumption; labour; Employment, unemployment and inflation; enterprenaurship: its role in economic development; Investment in human capital; social-political factors and their influence on economic development; the role of agriculture in economic development; agricultural development planning with special reference to the development projects, agricultural credit, irrigation, mechanization, settlement, roads and special rural development projects.

Lecture - 30 hrs; C.F. 3
Y3 T2 - All streams.

ECON 621: FARM MANAGEMENT

Principles of farm planning and budgeting; Selecting farm enterprises and planning a rotation program, the farm layout; the value of farm records for budgeting; planning techniques; gross margin analysis; partial budgeting; complete budgeting including major farm reorganization and planning a new farm; program planning; farm enterprise studies; performance measures and their application in farm management.

Lecture - 40 hrs; C.F. 4
Y2 T2 - ED
Y2 T3 - All streams except DT, FM, and ED

ECON 631: FARM RECORDS AND ACCOUNTS

Importance of farm records; types of farm records and how to keep suitable records; accounting procedures; journalizing ledger, cash analysis and petty cash books; accounting documents and their use; the balance sheet, trading account and proving accounts and valuation. Performance measures.

Lecture - 30 hrs; C.F. 3
Y2 T1 - ED, ENG
Y2 T2 - All Streams except ED and ENG

Education and Extension Department (7 . . . .)

*EDUC 711: INTRODUCTION TO LANGUAGE COMMUNICATION

Meaning of communication; forms of communication, e.g. spoken language, written language, communication by signs; speech making; forms of public address e.g. lectures, debates; choice of topic and the level of audience; effective conclusion; prepared and unprepared speech; code switching and code mixing in language communication; introduction to language writing; translation of texts.

Lecture - 30 hrs; C.F. 3
Y1 T1 - ED, ENG, RM
Y1 T2 - HEC, AG, AH, DT, FM

*EDUC 712: TECHNICAL WRITING AND REPORTING

Meaning and scope of technical writing and reporting; main principles; types of reports; the techniques of technical writing; style and presentation; definitions and multiple meanings and writing a model report.

Lecture - 20 hrs; C.F. 2
Y2 T3 - HORT, AG, FM, AH, HEC, FM, ENG
Y3 T3 - ED

*EDUC 731B: EDUCATIONAL TECHNOLOGY II

The content includes: technical background i.e. the application of electrophysical principles in educational technology; graphics; photo-technology; video systems; audio systems; audio-video systems; special problems; mass and national development; repairs and administration of communications technology; Graphics; photo-technology; special problems; mass media and national development, repairs and administration of communications technology; special techniques in mediated adult education.

Lecture/Practical - 20/40 hrs; C.F. 4
Y3 T1 - ENG.

EDUC 751: INTRODUCTION TO RURAL SOCIOLOGY

Analysis of human society and the individual as a member of the family, the community and other social systems. Rural sociology and its importance; culture --its importance, cultural change, and effects of the change; group relations; kinds of groups and their importance; social structure and its implications to social change; power and community decision making process; social institutions; social change diffusion and adoption process; adult learning.

Lecture - 30 hrs; C.F. 3
Y2 T3 - All streams except DT and ED.

EDUC 752: PRINCIPLES OF EXTENSION EDUCATION

Role and functions of Extension Education in agricultural and rural development with particular reference to developing countries; Historical background of the development of extension services and its present organizational structure, scope of work, long and short term goals and problems in relation to the basic principles and philosophy of extension education; the duties and responsibilities of extension educators in comparative or similar system.

Lecture - 20 hrs; C.F. 2 (30 hrs; C.F. 3 for ED)
Y3 T1 - All streams except DT and ED
Y3 T2A - ED.

EDUC 756: GOVERNMENT PROCEDURE

General Introduction; government organization and administration; Principles and theories of administration; Important considerations on joining the government--some preliminary procedural matters to be dealt with at the time of entry. Staff functions and responsibilities.

Lecture - 20 hrs; C.F. 2
Y3 T3 - All Streams except ED.

Engineering Department (8 . . . .)

ENGIN 811: INTRODUCTORY STATISTICS

Basic concepts of statistical models, distributions, probability, random variables; tests of hypothesis; confidence intervals; regression, correlation, sampling; experimental errors.

Lecture - 30 hrs; C.F. 3
Y1 T1 - AG, FM, AH, DT, RM, HORT
Y1 T2 - ED, HEC.

ENGIN 813: PHYSICS

Fundamental principles of physics. Pressure; elementary thermodynamics; electricity and magnetism.

Lecture/Practical - 20/20 hrs; C.F. 4
Y1 T1 - DT

ENGIN 813A: MECHANICS

Work, power and energy; simple machines, kinematics and kinetics of motion; introduction to hydrostatics, hydrodynamics; flow measurements.

Lecture/Practical - 20/20 hrs; C.F. 3
Y1 T2 - ENG.

ENGIN 813B: ELEMENTARY THERMODYNAMICS AND ELECTRICITY

Introduction to the laws of thermodynamics; thermal properties of matter; heat measurements and heat transfer; introduction to electricity; fundamental concepts; electric circuits; instrumentation and power.

Lecture/Practical - 30/20 hrs; C.F. 4
Y1 T3 - ENGIN.

ENGIN 814: ELEMENTARY SKETCHING

Use of sketching to illustrate ideas, isometric and perspective sketching; line, circle and ellipse construction, proportioning, lettering; introduction to elementary building plans.

Lecture/Practical - 10/20 hrs; C.F. 2
Y1 T1 - AG, AH, ED, FM, RM
Y1 T2 - DT

ENGIN 815: DRAWING I

Lettering; use of instruments; geometric construction; orthographic projection; sections; conventions; and dimensioning, introduction to elementary construction plans.

Lecture/Practical - 20/20 hrs; C.F. 3
Y1 T2 - ENG.

ENGIN 816: DRAWING II

Use of sketching to introduce the principles of oblique and isometric pictorial projection.

Lecture/Practical - 10/30 hrs; C.F. 2
Y1 T3 - ENG.

ENGIN 817: MATHEMATICS

Introduction to the slide rule; statistics and other selected topics.

Lecture/Practical - 30/20 hrs; C.F. 4
Y1 T1 - ENG.

ENGIN 818: SURVEYING I

Elementary techniques of horizontal distance measurements; differential levelling; measurement of direction; compass and compass traversing; plane table; topographic surveying; map drafting.

Lecture/Practical - 20/30 hrs; C.F. 3
Y2 T1 - ENG, RM
Y2 T2 - FM.

ENGIN 819: SURVEYING II

Introduction to the transit and theodolite, transit and theodolite surveys; stadid surveying (tacheometry); area and volume computations, construction surveying, introduction to photogrammetry.

Lecture/Practical - 20/30 hrs; C.F. 3
Y2 T2 - ENG

ENGIN 820: WELDING PRACTICE

Introduction to arc and axyacelyline welding, bronze welding and soldering. Emphasis on selection of correct welding method and materials.

Lecture/Practical - 10/30 hrs; C.F. 3
Y1 T2 - ENG.

ENGIN 823: WORKSHOP FABRICATION

Introduction to wood and metal fabrication and assembly techniques; proper use and tool selection; introduction to fasteners such as: bolts, rivets, nails, screws, glue and welding.

Lecture/Practical - 10/30 hrs; C.F. 2
Y1 T2 - AH, AG, FM, HORT
Y1 T3 - RM

ENGIN 824: WOODWORKING AND SKETCHING

An introduction in the correct selection, use and maintenance of woodworking hand tools; material selection and layout procedures are included; the use of sketching for introducing the principles of oblique and isometric pictorial projections.

Practical - 40 hrs; C.F. 2
Y2 T1 - HEC

ENGIN 825: WORKSHOP

Introduction in the correct selection; use and maintenance of wood and metal working hand tools; material selection; layout procedures and workshop layout.

Lecture/Practical - 20/40 hrs; C.F. 4
Y1 T1 - ENG, ED, DT

ENGIN 826: POWER-SHOP EQUIPMENT

Instruction in the use, adjustment and maintenance of wood and metal shop equipment, emphasis on selection of correct tools for adjustment and maintenance of this equipment.

Lecture/Practical - 20/20 hrs; C.F. 3
Y1 T3 - ED, ENG.

ENGIN 830: ELECTRIC POWER

Electrical wiring, lighting, power and control systems; AC and DC motors and generators, automatic electrical systems; selection, use and maintenance of electrical equipment.

Lecture/Practical - 20/30 hrs; C.F. 4
Y2 T3 - ENG, DT

ENGIN 831: PLANT ENGINEERING

Analysis of plant layout based on considerations of products; processes; product flow; functional design; space requirements; equipment; labor efficiency; and costs.

Lecture/Practical - 20/20 hrs; C.F. 4 (ENG)
Lecture - 20 hrs; C.F. (DT)
Y3 T1 - DT
Y3 T2 - ENG

ENGIN 832: PROCESS ENGINEERING

Application of engineering principles to agricultural processes; size reduction; cleaning, grading, sorting, material handling, drying, refrigeration and process analysis.

Lecture/Practical - 20/30 hrs; C.F. 4
Y3 T2 - ENG

ENGIN 840: FARM MACHINERY WORKSHOP PRACTICE

Assembly; repair and maintenance of farm machinery and their components.

Lecture/Practical - 20/30 hrs; C.F. 3
Y1 T2 - ENGIN

ENGIN 841: TRACTOR SERVICING AND OPERATION

Maintenance of tractors and operation with and without associated implements; emphasis on daily and weekly servicing; introduction to hydraulic systems.

Lecture/Practical - 40/60 hrs; C.F. 6 (ENG)
Lecture/Practical - 10/20 hrs; C.F. 2
Y1 T1 - AG, FM, HORT
Y1 T3 - AH, ED
Y1 T1 and Y1 T2 - ENG
Y2 T1 - RM

ENGIN 842: OXEN AND SMALL EQUIPMENT

Principles of training and use of oxen; the introduction of the ideas of small equipment and their use.

Lecture/Practical - 10/30 hrs; C.F. 2
Y1 T3 - ENG

ENGIN 843: FARM POWER I

Fundmental principles and operation of internal combustion engines; construction; design; operation maintenance of valve system; bearings; rings; fuel delivery and motoring; ignition; electrical; air cleaner; cooling and lubricating systems.

Lecture/Practical - 20/40 hrs; C.F. 4
Y2 T1 - ENG.

ENGIN 844: FARM POWER II

Introduction to operation; maintenance and repair of auxiliary components of transport equipment; gear box and final drives; brakes, steering mechanisms, chasis, suspension, clutch and hydraulic systems; determination of shop equipment for specific operations.

Lecture/Practical - 10/30 hrs; C.F. 3
Y2 T2 - ENG

ENGIN 845: FARM MACHINERY I

General theoretical and practical introduction to farm machinery with a general coverage of tillage, planting, cultivation and crop spraying, emphasis on capabilities; operation and maintenance.

Lecture/Practical - 20/30 hrs; C.F. 4
Y1 T3 - ENG.

ENGIN 846: POWER AND MACHINERY

Practical introduction to mounted and trailed implements; i.e. tillage, planting, cultivations and spraying; maintenance and management.

Lecture/Practical - 20/30 hrs; C.F. 3
Y1 T3 - AG, FM, HORT
Y2 T1 - AH, ED

ENGIN 847: FARM MACHINERY II

Practical introduction to forage, grain and row crop harvesting machinery; and light bush clearing equipment; emphasis on capabilities; operation and maintenance.

Lecture/Practical - 20/30 hrs; C.F. 4
Y2 T2 - ENG.

ENGIN 848: FARM MACHINERY MANAGEMENT

Introduction to practical machinery management; performance testing of agricultural machinery and systems.

Lecture/Practical - 20/30 hrs; C.F. 3
Y2 T1 - ENG.

ENGIN 850: FLUID MECHANICS

Hydrostatics; hydrodynamics; viscous resistance to flow; pipe flow; open channel flow.

Lecture/Practical - 20/30 hrs; C.F. 4
Y2 T2 - ENG.

ENGIN 851A: SOIL AND WATER CONSERVATION - UTILIZATION

General coverage of hydrology, water and wind erosion; erosion control practices and structures--terraces, ditches, ponds, dams, water spreading etc.

Lecture/Practical - 20/30 hrs; C.F. 4
Y2 T3 - RM, FM
Y3 T1 - ENG

ENGIN 851B: SURVEYING, SOIL AND WATER CONSERVATION

Elementary Surveying: Horizontal distance measuring; differential levelling; land area measurement; plane table; and mapping.

Soil and Water Conservations: General hydrology; water and wind erosion; erosion control practices and structures; water conservation and storage, and water spreading; surface drainage.

Lecture/Practical - 30/30 hrs; C.F. 3
Y2 T3 - AG, HORT
Y1 T3 - ED
Y2 T2 - AH

ENGIN 851C: SOIL AND WATER ENGINEERING

(Course outline to be developed).

ENGIN 852: WATER SUPPLY FOR RANGE MANAGEMENT

General introduction and appreciation of the technical problems of water supply; development and utilization in range areas; includes water conservation, spreading, pumping, piping, storage and management.

Lecture/Practical - 20/30 hrs; C.F. [illegible]
Y3 T1 - RM.

ENGIN 853: WATER SUPPLY AND IRRIGATION FOR AGRICULTURE

Covers general knowledge and appreciation of the technical problems of water supply and irrigation; water development; storage; pumping, piping and management of systems; general requirements of irrigation; application rates, and techniques of [illegible]

Lecture/Practical - 20/30 hrs; C.F. 3
Y3 T2 - AG, HORT, FM

ENGIN 854: RURAL WATER SUPPLY AND SEWERAGE

Introduction to water usage and legal aspects; covers water development and management; pumping; piping, storage, and water treatment systems; fundamental principles of sewerage disposal and water sanitation.

Lecture/Practical - 20/30 hrs; C.F. [illegible]
Y2 T3 - ENG.

ENGIN 855A: OVERHEAD IRRIGATION

Covers principles and practices of irrigation with coverage of feasibility; site selection; soil and water measurements; design; layout; operation and maintenance of sprinkler systems.

Lecture/Practical - 20/30 hrs; C.F. 4
Y2 T3 - ENG.

ENGIN 855B: SURFACE IRRIGATION

Covers principles and practices of surface irrigation including site selection, soil and water relationships, design, water and conveyance systems; land leveling and surface irrigation structure.

Lecture/Practical - 20/30 hrs; C.F. 4
Y3 T2 - ENG.

ENGIN 860: STATICS

Fundamental definitions and the concept of static equilibrium; systems of trusses and frames, centroids and moments of inertia.

Lecture/Practical - 20/20 hrs; C.F. 4
Y1 T3 - ENG.

ENGIN 861: STRENGTH OF MATER

The study of tensile, compressive, shear and bending stresses in materials under various types of loads; designing and testing various structural members constructed of concrete, steel, masonary, timber and other materials.

Lecture/Practical - 20/20 hrs; C.F. 4
Y2 T1 - ENG.

ENGIN 862: FARM STRUCTURES

Farmstead structural requirements; animal and product; space and environmental considerations; basic building construction and material selection.

Lecture/Practical - 20/20 hrs; C.F. 3
Y3 T1 - ED
Y2 T1 - FM
Y2 T2 - AG, HORT

ENGIN 863: BUILDING DESIGN ENGINEERING

Design and layout of farm structures based on consideration of animal and product loading; space and environmental requirements; availability of building materials and assembly techniques.

Lecture/Practical - 20/30 hrs; C.F. 4
Y3 T1 - ENG.

ENGIN 864: CONCRETE STRUCTURES

Design and construction of selected concrete structures; includes foundations, floors, walls, drainage, water storage etc.

Lecture/Practical - 20/30 hrs; C.F. 4
Y2 T2 - ENG.

ENGIN 865: FARM STRUCTURES

Farmstead and range structure requirements, i.e., fencing, gates, grids, roads, dips, spray races, water storage, feed and grain storage and animal housing.

Lecture/Practical - 20/20 hrs; C.F. 3
Y3 T2 - AH, RM

ENGIN 871A: STUDENT PROJECTS

Design of an engineering project requiring knowledge and skills acquired in previous courses.

Project - 10 hrs; C.F. 1
Y3 T1 - ENG.

ENGIN 871B: STUDENT PROJECTS

Construction of project designed in 871A.

Project - 30 hrs; C.F. 2
Y3 T2 - Eng.

ENGIN 872: OUTSIDE VISITS

Visits to various farming centers and industrial operations to expose the students to various field applications of their engineering knowledge and skills.

Visits/Tours - 40 hrs; C.F. 2
Y3 T3 - ENG.

ENGIN 874: SEMINARS

Discussions of various Agricultural Engineering problems and employment opportunities by Guest Speakers.

Seminars - 40 hrs; C.F. 2
Y3 T3 - ENG.

ENGIN 875: FIELD EXPERIENCE

Designed to give Engineering students practical field experience in mechanized agriculture from tillage to harvesting. Emphasis is placed on individual initiative and programming; this is a three term course. During Y3 T2 a project outside machinery operation will be carried out.

Practical - 160 hrs; C.F. 3 (80 hrs; C.F. 5 in Y3 T2 only)
Y2 T3; Y3 T1 and Y3 T2 - ENG.

FIELD ATTACHMENT

A. In order to strengthen the practical skills obtained during course work, the College may arrange "Field Attachment" for students during the long vacation falling in April/May of each year. Depending on the Diploma Course being taken the students may be attached to the following:

1. General Extension (under District Agricultural Officer).
2. Farmers Training Center or Agricultural Institute.
3. Irrigation Scheme.
4. Dairy Factory.
5. Research Station.
6. Agro-mechanical workshop.
7. Large Scale Farms.
8. Agricultural Cooperative Societies.

B. During such attachments the students will be expected:

--to work under expert supervision.

--to observe experience personnel.

--to carry out any specific assignment or projects given by the College.

--Write reports for submission to the College.

--Learn manual skills.

--Learn to live and work with people under field conditions.

C. In assessing the performance of field attachment, reports from students as well as supervisors will be made use of. Departmental staff may also visit the students for such assessment.

APPENDIX II

Proposed New Courses

ENGR 828: WORKSHOP MANAGEMENT

To be written by Egerton Staff

ENGR 830A: ELECTRIC POWER I - FUNDAMENTALS

Electricity generation and transmission; transformers; wiring and wire sizing; lighting circuits and controls; operation and use of voltmeters, ammeters, wattmeters; safety; load requirements for various farm users (i.e., motors, lights, pumps, milkers, etc.).

Practical: Those applicable exercises now in Engr. 830 plus losses in various wire sizes, figuring load requirements in shops and other farm buildings, check wire sizes for existing load in at least one building.

Lecture/Practical - 20/30 hrs
Y2 T2 - Engr.

ENGR 830B: ELECTRIC POWER II - APPLICATIONS

Power circuits and controls; automatic and manual controls; automatic and manual controls; line metering; electric motors and control units; uses of electric motors; types of AC and DC motors; motor sizing for various load requirements; cleaning and repair of electric motors.

Practical: Make a DC electric motor from wire, tin, and nails; disassemble, clean, and reassemble all kinds of motors; DC, split phase, capacitor, series.

Lecture/Practical - 20/30 hrs
Y2 T3 - Engrs.

ENGR 832A: PROCESS ENGINEERING I

(To be written by Egerton Staff)

ENGR 832B: PROCESS ENGINEERING II

(To be written by Egerton Staff)

ENGR 843A: FARM POWER I - SMALL ENGINE REPAIR

Operation principles of small gasoline and diesel engines, parts identification; ignition, timing; carburation fuel injection; overhaul; uses; trouble shooting, single piston engines.

Practical: Complete dissassembly and reassembly of both gasoline and diesel engines during the term.

Lecture/Practical - 10/40 hrs.
Y2 T1

ENGR 843B: FARM POWER II - ENGINE ELECTRICAL SYSTEMS

(To be written by Egerton Staff)

ENGR 843C: FARM POWER III - TESTING AND TROUBLE SHOOTING

(To be written by Egerton Staff)

ENGR 845A: FARM MACHINERY I

(To be written by Egerton Staff)

ENGR 850A: FLUID MECHANICS I - FUNDAMENTALS

Hydrostatics, hydrodynamics; viscous resistance to flow; continuity and Bernoulli's equations; incompressible flow; laminar and turbulent flow; flow meters.

Practical: Problems and lab equipment comparable to worked covered in lecture.

Lecture/Practical - 20/30 hrs
Y2 T1 - Engr.

ENGR 850B: FLUID MECHANICS II -HYDRAULICS

Pipe flow; friction loss in pipes and fittings; pipe flow measurement; open channel flow; water measuring devices; hydraulic jump; control structures for open channel flow.

Practical: Measure head loss in pipes; measure flow in pipes; venturi meters, pitot tube, orifice, elbow meter, free flow from open pipe; measure open channel flow; wiers, parshall flume, other flumes, float method; measure river flow - slope area method, current meters; rated section.

Lecture/Practical - 20/30 hrs
Y2 T2

ENGR 851: SOIL AND WATER CONSERVATION

(To be written by Egerton Staff)

ENGR 851C: SOIL AND WATER ENGINEERING

(to be written by Egerton Staff)

ENGR 855C: DRAINAGE

(To be written by Egerton Staff)

ENGR 856A, B, C: FIELD EXPERIENCE I, II, and III

(To be written by Egerton Staff)

ENGR 857A, B: STUDENT PROJECTS I and II

(To be written by Egerton Staff)

ENGR 858A: LAND USE PLANNING

(To be written by Egerton Staff)

ENGR 864: SOIL MECHANICS

Soil as construction medium; load carrying capacity; forces exerted by soil; compaction; atterburg limits; shear and compression tests; slope stability; foundation design.

Practicals: Atterburg limits; compaction; shear strength; compression loads; permeability.

Lectures/Practical - 20/30 hrs
Y2 T2

ENGR 875A, B: MACHINERY REPAIR PRACTICE I and II

(To be written by Egerton Staff)

ENGR 880: HYDROLOGY AND METEOROLOGY

Hydrologic cycle; storm frequency and intensity; runoff rates and volumes; unit hydrograph; prediction methods from meteorologic data.

Lecture/Practical - 30/30 hrs
Y2 T1

ENGR 881: PUMPS AND PUMPING

Kinds of pumps - hand; deep well, wind mill, centrifugal, turbine, jet; hydraulic ram; power requirements; maintenance and repair of pumps; when and where to use.

Practical: Disassemble and reassemble a variety of pumps; run pump tests for diagnosis; develop characteristic pump curves.

Lecture/Practical - 20/30 hrs
Y2 T1

ENGR 882: WATER RESOURCE SYSTEMS

Pipeline design and construction; valves; meters; pressure regulators; taps; float valves; sandfilters; chlorinators; looping distribution; livestock watering troughs.

Practical: Pipe line construction; fittings; valve operation and repair; float valve maintenance.

Lecture/Practical - 20/30 hrs
Y2 T3

ENGR 883: WATER RESOURCE PLANNING

Planning water supply locations; conceptual plans of distribution systems; water needs; supply evaluation; range requirements for livestock; multiple use.

Lecture/Practical - 30/0 hrs
Y3 T1

ENGR 884: WATER RESOURCE SUPPLY

Design and construction of boreholes; dug wells; underground tanks; overhead tanks; water harvesting systems; maintenance of the preceding supplies; sanitation requirements.

Practical: Outside visits; operation of maintenance equipment; problems on capacity requirements.

Lecture/Practical - 30/20 hrs
Y3 T1

ENGR 885: DAMS AND SPILLWAYS

Design of small earth dams; suitable fill materials; foundations and abutments; zones within a dam, types of dams; sealing dams; spillways; outlet structures; riprap; reservoir capacity; spillway capacity.

Practicals: Survey reservoir site and dam sites. Compute volume of earth work; compute volume of reservoir; locate outlet works; locate regular overflow spillway; design and locate emergency spillway; examine soils for suitability to use as fill materials.

Lecture/Practical - 30/20 hrs
Y3 T1

ENGR 886A, B, and C: FIELD EXPERIENCE I, II and III

Three terms of field experience which will allow students opportunity to use what they have learned in the classroom. Could include pipeline installation both plastic and steel on campus, installation of water systems for native villages in the area, work with range department to plan a water supply network for an arid range area; design and install an underground tank for range water; etc.

Lecture/Practical - 10/30 hrs
Y2 T3, Y3 T1 and Y3 T2

ENGR 887A and B: STUDENT PROJECTS I and II

As complete a design of a water resource system for a village or a range land area as time and facilities will allow.

Lecture/Practical -
Y3 T1 - 10/0
Y3 T2 - 0/30

ENGR 888: WATER LAW AND GOVERNMENT POLICY

Kenyan Water Law; acquisition of water rights; duration of the rights; loss of rights; system of priorities; duty of water; enforcement; policy on water development; policy on administration; organization of water organizations; etc.

Lecture/Practical - 30/0 hrs
Y3 T1

APPENDIX III

Staff Requirements

Table III-1. Minimum Staff Requirements for Expanded Agricultural Engineering.

Course No.	Course Title	Contact hrs per week		Number of Students		Staff Required		Classes per Year Number and Size	
		Lect	Pract	Engr	Other	Lect*	Dem**	Lect	Pract
811	Introductor Statistics	3			500	1	1***	9@ 60	
813	Physics	2	2	30	40	.13	.33	2@ 40	
813A	Mechanics	2	2	60		.07	.27	1@ 60	
813B	Elem. Thermo	3	2	60		.10	.27	1@ 60	
						1.30	1.87		
814	Elem. Sketch		3		430	1	.5	15@ 30	
815	Drawing I	1	3	90		.20	.25	3@ 30	
816	Drawing II	1	3	90		.20	.25	3@ 30	
						1.40	.75		
817	Mathematics	3	2	90		.30	.2	3@ 30	
						.30	.20		
818	Surveying I	2	3	90	140	.53	1.07	8@ 30	16@ 15
819	Surveying II	2	3	60		.13	.26	2@ 30	4@ 15
						.66	1.33		

* 300 lectures per year (10 lectures/wk, 10 wks/term, 3 terms/yr) is used as one full time teaching load.

** 150 demonstrations per year (5 3-hr dems/wk, 10 wks/term, 3 terms/yr) plus grading is used as a full time load.

*** used as a grader only

Table III-1 cont'd. Minimum Staff Requirements for Expanded Agricultural Engineering Program.

Course No.	Course Title	Contact hrs per week		Number of Students		Staff Required		Classes per Year Number and Size	
		Lect	Pract	Engr	Other	Lect	Dem	Lect	Pract
818	Surveying I	2	3	90	140	.53	1.07	8@ 30	16@ 15
819	Surveying II	2	3	60		.13	.26	2@ 30	4@ 15
						.66	1.33		
820	Welding Practice	1	3	90		.10	.60	3@ 30	9@ 10
823	Workshop Fabrication	1	3		330	.37	1.47	11@ 30	22@ 15
824	Woodworking and Sketching		4		50		.27		4@ 12
825	Workshop	2	4	90	100	.13	.87	2@ 95	13@ 15
826	Power Shop Equip.		4	90	60		1.00		15@ 10
828	Workshop Management	2	2	30		.07	.07	1@ 30	2@ 15
						.67	4.28		
830A	Elect. Power I	2	3	90	40	.27	.60	4@ 35	9@ 15
830B	Elect. Power I	2	3	60		.13	.27	2@ 30	4@ 15
						.40	.87		
831	Plant Engr.	2	2	90		.20	.40	3@ 30	6@ 15
832A	Process Engr. I	2	3	90		.20	.40	3@ 30	6@ 15
832B	Process Engr. II	2	3	30		.07	.13	1@ 30	2@ 15
						.47	.93		
840	Farm Mach. Workshop	2	3	90		.20	.60	3@ 30	9@ 10
841A	Tract. Serv. & Op.	2	3	90	390	.30	3.20	5@ 100	48@ 15

Table III-1 cont'd. Minimum Staff Requirements for Expanded Agricultural Engineering Program.

Course No.	Course Title	Contact hrs per week		Number of Students		Staff Required		Classes per Year Number and Size	
		Lect	Pract	Engr	Other	Lect	Dem	Lect	Pract
841B	Tract Serv. & Op.	2	3	30		.07	.20	1@ 30	3@ 10
842	Oxen and Small Equip.	1	3	90		.10	.40	3@ 30	6@ 15
843A	Farm Power I	2	3	90		.20	.60	3@ 30	9@ 10
843B	Farm Power II	2	3	30		.10	.20	1@ 30	3@ 30
843C	Farm Power III	2	3	30		.10	.20	1@ 30	3@ 10
844	Farm Power Traing.	2	3	30		.10	.20	1@ 30	3@ 10
						1.17	5.60		
845A	Farm Machinery I	2	3	30		.10	.20	1@ 30	3@ 10
845B	Farm Machinery II	2	3	30		.10	.20	1@ 30	3@ 10
845C	Farm Machinery III	2	4	30		.10	.20	1@ 30	3@ 10
846	Farm Power & Machinery	3	3	60	330	1.30	1.73	13@ 30	26@ 15
847	Conserv. Equip.	2	3	90		.20	.60	3@ 30	9@ 10
848	Farm Mach. Manag.	3	4	30		.10	.13	1@ 30	2@ 15
849	Hydraulic Systems	1	3	30		.10	.13	1@ 30	2@ 15
						2.00	3.19		
850A	Fluid Mech I	2	3	90		.20	.40	3@ 30	6@ 15
850B	Fluid Mech II	2	3	60		.13	.27	2@ 30	4@ 15
						.33	.67		
851	Soil & Water Cons.	2	3	30		.07	.13	1@ 30	2@ 15
851A	Soil & Water Cons. Utilization	3	3	60	140	.40	.93	4@ 15	14@ 15

Table III-1 cont'd. Minimum Staff Requirements for Expanded Agricultural Engineering Program.

Course No.	Course Title	Contact hrs per week		Number of Students		Staff Required		Classes per Year Number and Size	
		Lect	Pract	Engr	Other	Lect	Dem	Lect	Pract
851B	Surv. Soil & Water Cons.	3	3		250	.50	1.13	5@ 50	17@ 15
851C	S & W Engr.	2	3	60		.13	.27	2@ 30	4@ 15
852	W Sup. for Range Manage.	2	3		60	.07	.27	1@ 60	4@ 15
853	W Sup & Irrig.	2	3	30	170	.27	.53	4@ 50	8@ 25
854	W Sup & Sewage	2	3	30		.07	.13	1@ 30	2@ 15
855A	Overhead Irrig.	2	3	30		.07	.13	1@ 30	2@ 15
855B	Surf. Irrig.	2	3	30		.07	.13	1@ 30	2@ 15
855C	Drainage	3		60		.20		2@ 30	
858	Land Use Planning	3	2	30		.10	.13	1@ 30	2@ 15
						1.95	3.78		
860	Statics	2	2	90		.20	.40	3@ 30	6@ 15
861	Strength of Mat.	2	2	90		.20	.40	3@ 30	6@ 15
862A	Farm Struct. I	2	2		230	.27	1.07	4@ 60	16@ 15
862B	Farm Struct II	2	2		160	.20	.73	3@ 60	11@ 15
863	Build. Des. Engr.	3	3	90		.30	.40	3@ 30	6@ 15
864	Soil Mech.	2	2	60		.13	.27	2@ 30	4@ 15
						1.30	3.27		
875A	Mach. Repair Pract. I		4	30			.60		9@ 10
875B	Mach, Repair Pract. II		4	30			.40		6@ 10
							1.00		

Table III-1 cont'd. Minimum Staff Requirements for Expanded Agricultural Engineering Program.

Course No.	Course Title	Contact hrs per week		Number of Students		Staff Required		Classes per Year Number and Size	
		Lect	Pract	Engr	Other	Lect	Dem	Lect	Pract
880	Hydrology & Meterology	3	3	60		.20	.13	2@ 30	2@ 30
881	Pumps & Pumping	2	3	60		.13	.27	2@ 30	4@ 15
882	Water Res. Systems	2	3	30		.07	.13	1@ 30	2@ 15
883	Water Res. Planning	3		30		.10		1@ 30	
884	Water Res. Supply	2	3	30		.07	.13	1@ 30	2@ 15
885	Dams & Spillings	2	3	30		.07	.13	1@ 30	2@ 15
888	Water Law & Govt. Policy	3		30		.10		1@ 30	
						.74	.79		
			Total Requirement			12.69	28.53		