

**BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR THE IMPROVEMENT OF
EDUCATIONAL EQUIPMENT
FOR
THE FACULTY OF AGRICULTURE,
UNIVERSITY OF PERADENIYA
IN
THE DEMOCRATIC SOCIALIST REPUBLIC
OF SRI LANKA**

FEBRUARY 1997



JAPAN INTERNATIONAL COOPERATION AGENCY
OVERSEAS MERCHANDISE INSPECTION CO.,LTD

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**MINISTRY OF EDUCATION AND HIGHER EDUCATION
THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA**

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PREFACE

In response to a request from the Government of the Democratic Socialist Republic of Sri Lanka, the Government of Japan decided to conduct a basic design study on the Project for the Improvement of Educational Equipmet for the Faculty of Agriculture, University of Peradeniya and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Sri Lanka a study team from August 11 to September 7, 1996.

The team held discussions with the officials concerned of the Government of Sri Lanka and conducted a field study at the study area. After the team returned to Japan, further studies were made, and as this result, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to be the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Democratic Socialist Republic of Sri Lanka for their close cooperation extended to the team.

February 1997



Kimio Fujita

President

Japan International Cooperation Agency

February 1997

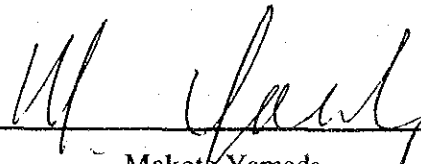
Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project for the Improvement of Educational Equipment for the Faculty of Agriculture, University of Peradeniya in the Democratic Socialist Republic of Sri Lanka.

This study was conducted by Overseas Merchandise Inspection Co.,Ltd., under a contract to JICA, during the period from July 31, 1996 to February 3, 1997. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Sri Lanka and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,



Makoto Yamada

Project manager

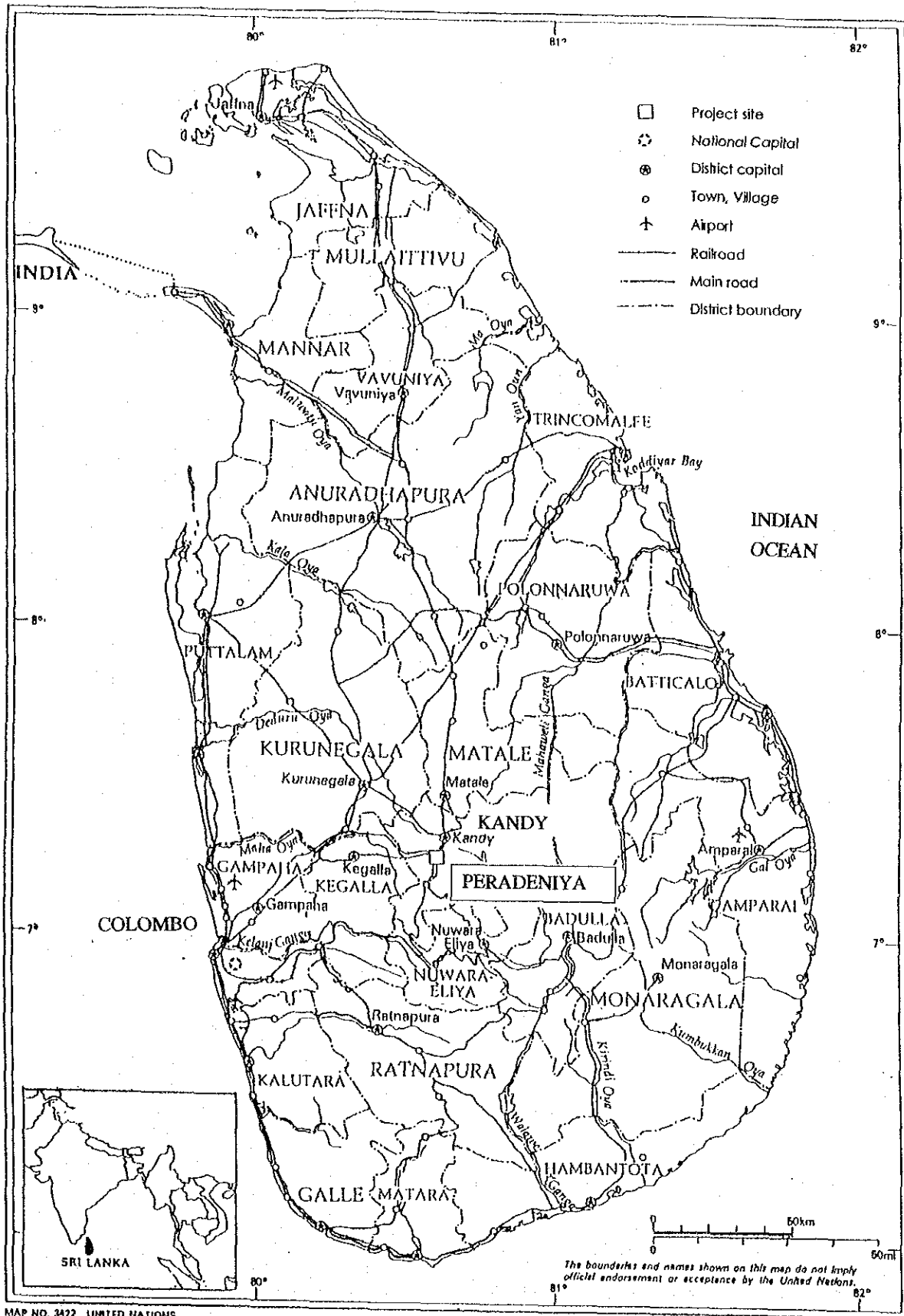
Basic design study team on

the Project for the Improvement of Educational
Equipment for the Faculty of Agriculture,

University of Peradeniya

Overseas Merchandise Inspection CO.,LTD

THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA



MAP NO. 3422 UNITED NATIONS
DECEMBER 1986

SKETCH MAP OF UNIVERSITY OF PERADENIYA

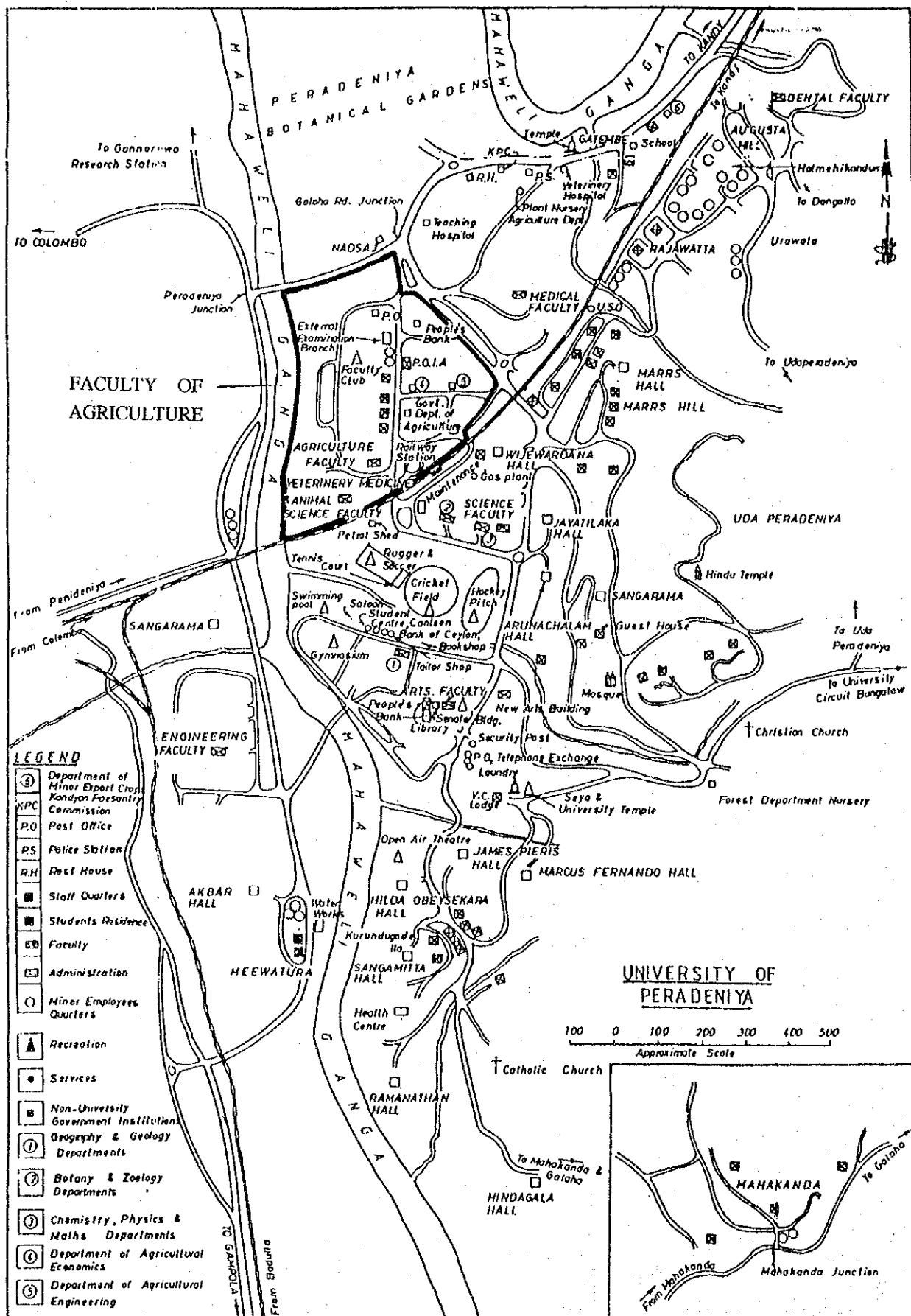


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Chapter 1. Background of the Project

Chapter 1. Background of the Project

1-1 Background of the Project

Sri Lanka is in the process of diversifying its economy, with considerable development of the textile and service industries. Although the share of agriculture in the national economy is lowering, agricultural, forestry and fishery production still accounts for 20.3% of GNP. Agriculture also plays an important role in earning foreign currency as agricultural products and processed agricultural goods account for approximately 70% of the nation's total commodity exports. Labor engaged in agriculture, forestry and fishery accounts for 40% of the total working population of Sri Lanka. About 70% of total population resides in rural areas, thus, in Sri Lanka society and the economy are largely dependent on agriculture. Sound development of agriculture is therefore indispensable for the development of Sri Lanka's national economy.

In the 14th Five-year Programme of Public Investment (1993-1997), the Government of Sri Lanka has emphasized the improvement of self-sufficiency production rates of staple foods such as rice and beans, as well as the development of agricultural processing industries. However, the circumstances of the agricultural sector have been severe. Estate agricultural products represented by tea, rubber, and coconuts had once been the major earners of foreign currency but are now stagnant due to inflexible weakened management of corporations and low international prices for such products. On the other hand, production of food crops such as rice and beans largely depends on natural conditions, especially precipitation. The Government of Sri Lanka plans to increase and stabilize food production in the Mahaweli River area by increasing acreage of irrigated farmland. In addition, the Government is guiding a large number of farmers in the introduction of high yield varieties and their new cultivating methods, although this is not an easy task. Consequently, productivity has not increased much and about one quarter of the rice demand remains reliant on imports, resulting in the spending of precious foreign currency.

In order to diversify agriculture and to increase farmers' income, efforts are being made

to promote horticultural crops such as vegetables, fruits and flowers, as well as the livestock industry and dairy farming. However, this requires improvements in many fields, such as establishing domestic sales channels in both domestic and foreign markets, building or improving domestic marketing facilities, and fostering related processing industry. At present, fields to be improved are too extensive and complicated and expected results have not yet been obtained.

Development of agriculture is indispensable in Sri Lanka, where agriculture plays such an important role socially and economically. Transfer of improved technology to farmers is important for the future development of agriculture in Sri Lanka. For this purpose, nurturing of personnel who have received higher education in agriculture is greatly required in terms of both quality and quantity. Through higher university education in agriculture, research / extension workers, subject matter specialists, lecturers, agricultural economists, managers, executives are reared in both the public and private sector. In particular, they are assigned the important task of guiding farmers, who are the mainstay of agriculture in Sri Lanka, on new technology and on improvement of farm management in order to increase farmers' income. Therefore, improvement of education, with an emphasis on more practical training, is imperative.

In spite of the above-mentioned importance of agricultural education, the number of students enrolled in the faculties of agriculture (bachelor program) account for only about 4% of all university students in Sri Lanka, considerably low compared with other ratios shown by the agricultural sector; GNP(20.3%) and labor force population(36.8%). The Government of Sri Lanka is now planning to establish new faculties of agriculture or to expand the existing faculties of agriculture at universities in order to meet the increasing demand for technical manpower needed to fulfill national development plans, such as Mahaweli Ganga Development Project, which is strongly promoting food production in that area, and the Janasaviya Program, which aims to alleviate the poverty of farmers and fishermen.

Table 1-1. Number of Students Enrolled in Each Faculty of Universities in Sri Lanka (1992/93)

	Number	%
Arts	9,529	31
Business Management, Commercial	5,450	18
Law	821	3
Science (Biology, Physics)	5,525	18
Medicine (Including dental science, veterinary)	4,861	16
Agriculture	1,323	4
Engineering, Architecture	3,255	10
Total	30,764	100

Source: Statistical Hand Book 1994, UGC (B.Sc. course only)

The executing agency, University of Peradeniya has seven faculties (Agriculture, Arts, Engineering, Science, Medicine, Veterinary Medicine & Animal Science, and Dental Science) and is the largest university in Sri Lanka in terms of the number of students, teaching staff, and campus area of 700 ha. . The Faculty of Agriculture, which was established in 1947, has about 900 enrolled students, equal to about 70% of the total number of agriculture students nationwide and plays an important role in Sri Lanka. In Sri Lanka, only University of Peradeniya has a Postgraduate Institute of Agriculture (PGIA) granting M.Sc. and Ph.D. degrees. About 300 students are currently enrolled in PGIA. Graduates from the Faculty have been actively working in government offices, research organizations, education & training facilities, and private companies throughout the country. They play an important role in the development and innovation of agricultural technology, one of the measures for promoting agriculture.

Table 1-2. Higher Education Institutions in Agriculture

Name of Institution	Number of Students			
	1989/90	1990/91	1991/92	1992/93
University of Peradeniya	1,033	1,137	1,108	900
Ruhuna University	247	246	271	288
Eastern University	71	61	60	49
Jaffna University	26	58	78	86
Total	1,377	1,502	1,517	1323

Source: Statistical Hand Book 1994, UGC (B.Sc. course only)

Most of the equipment in the Faculty of Agriculture was installed with assistance from the U.S. government between 1979 and 1985. The equipment consists of laboratory instruments and agricultural machinery necessary for conducting practical training and experimentation, as well as computers for general educational activities, equipment for making teaching materials and, audio-visual equipment.

Since this equipment has been operated for many years, it is worn-out and insufficient for current needs, thus leading to difficulties in providing practical training in accordance with the curriculum. Some superannuated equipment was once used by the professors when they were students and are still used by the present students.

In order to cope with the quantitative deficiency of the equipment for experiments conducted by all 1st and 2nd year students, 200 1st year students are divided into several groups and the same experiments are repeated many times. This has resulted in an increased burden on the teaching staff, a complex timetable, and complicated use of classrooms. Sometimes students can not attend classes. Deficiency or lack of necessary equipment further causes various inconveniences, that is, some experiments are conducted not by students themselves but by a demonstrator before many students, and for their graduation theses some students are forced to conduct experiments outside the university.

Under such circumstances, in December 1994 the Government of Sri Lanka requested

assistance from the Government of Japan to improve the equipment at the Postgraduate Institute of Agriculture (PGIA). At present, the Government of Sri Lanka is submitting a renewed request for grant aid assistance to improve the equipment for the Faculty of Agriculture, which is more important than the previous request for nurturing personnel who can directly influence farmers. This request aims to ;

- a) Upgrade the quality of education (increase the opportunities for students to participate in the experiments and practical training in order to improve the effect of training),
- b) Cope with the increased number of students,
- c) Strengthen and improve experiments and research activities, and
- d) Reinforce agricultural development.

In the past, Japan's Grant Aid was given to the Faculty of Engineering (1984) and the Faculty of Dentistry (1995 ongoing) at University of Peradeniya. Therefore, the implementation setup is expected to be relatively well organized.

1-2 Outline of the Project

The request from the Government of Sri Lanka covers laboratory equipment, agricultural machinery, audio-video equipment and a mini bus for students in the Faculty's Departments of Agricultural Biology, Food Science & Technology, Soil Science, Crop Science, Animal Science, Agricultural Engineering, Agricultural Economics and Agricultural Extension. All are intended to upgrade the quality of education and to improve the equipment necessary to realize practical education suitable for the present curriculum and the number of students.

Chapter 2. Contents of the Project

Chapter 2. Contents of the Project

2-1 Objectives of the Project

The primary objectives of the project is to provide educational equipment that is superannuated or lacking at the Faculty of Agriculture, University of Peradeniya, to make it suitable to the present curriculum and the number of students and teaching staff in order to strengthen the practical education and to upgrade the quality of education.

Secondary objectives is to accelerate agricultural development in Sri Lanka through nurturing capable manpower.

2-2 Basic Concept of the Project

2-2-1 Contents of the Request and Results of Discussion

The contents of the request from the Government of Sri Lanka and the contents of items agreed upon through discussions made during the field survey conducted this time are as shown in Table 2-1.

Our standpoints for the preparation of the basic design were as follows:

(1) *Safety in the use of equipment*

Equipment for experiments that involves radioisotopes should be omitted if the existing facility does not meet the proper conditions for using radiation, in order to protect operators and prevent contamination outside the facility.

(2) *Correlation with educational purpose*

Requested equipment to establish an FM radio station and cleaning equipment for management of the facilities should be omitted if the correlation with educational activities for students cannot be justified.

(3) *Within the range of grant aid (equipment) assistance.*

Equipment and materials for the irrigation facility at Dodangolla Experimental Farm should be omitted if they require large-scale civil engineering work.

(4) Joint use of equipment

In relation to such analyzing and measuring equipment as a Atomic absorption spectrophotometer, Amino-acid analyzer, Gas chromatograph, and Porometer, discussion shall be held on the possibility of realistic joint use, in consideration of the frequency of use, location of the installation, responsibility and cost division, and consciousness on possession.

(5) Discussion on the use of substitutes

Discussion shall be held on the possibility of reducing the number and/or use of substitutes by changing the method of measuring, indication of unit value, and accuracy of equipment, especially when physiological data are measured or soil constituents are analyzed by other kinds of equipment whose functions are identical or similar.

Table 2-1 Contents of Initial Request and Contents Agreed upon through Mutual Discussion

Contents of Request	Contents agreed upon through discussion	Explanation and justification for changes
A. Executing agency The Faculty of Agriculture, Univ. of Peradeniya.	Univ. of Peradeniya	• Name of the Faculty of Agriculture was mentioned in the request but Univ. of Peradeniya was cited as the executing agency in the Minutes of Discussions.
B. Project site The Faculty of Agriculture, Univ. of Peradeniya	Univ. of Peradeniya	
C. Implementing Organization The Faculty of Agriculture, Univ. of Peradeniya	Univ. of Peradeniya	

<p>D. Requested equipment</p> <p>1. General</p> <p>Contents of former request for PGIA and those presently requested for The Faculty of Agriculture are almost identical.</p>	<p>Items requested were examined. It was agreed to exclude items which are too much advanced experiments for undergraduates. Glassware and consumerbles shall be included in priority. The priority order was discussed and it was agreed that those items ranked level [C] may be excluded from the object of the project.</p>	<ul style="list-style-type: none"> • This project is intended to improve equipment for basic education and research work for undergraduate students.
<p>2. Dept. of Agricultural Biology</p> <p>Equipment used in personnel training and experiments related to plant pathology, plant physiology, entomology, plant breeding, microbiology and cytogenetics</p>	<p>The following pieces of equipment were classified as priority [C].</p> <p>Microscope w/polarizing equipment, portable infrared gas analyzer, amino-acid analyzer, chromatograph oven, gas chromatograph, etc.</p>	<ul style="list-style-type: none"> • These are not adequate from technical and operational viewpoints and joint use was judged possible.
<p>3. Dept. of Soil Science</p> <p>Equipment used in personnel training and experiments related to soil science, soil chemistry, soil fertility, soil minerals, soil biology, and plant nutrition</p>	<p>The following were classified as priority [C].</p> <p>Automatic C analyzer Automatic N analyzer ICPA, Radioisotope experimental equipment, cars, etc.</p>	<ul style="list-style-type: none"> • These are judged as too advanced or joint use was judged possible. • Safety facilities at the site were judged as insufficient for equipment related to radioisotope
<p>4. Dept. of Food Science & Technology</p> <p>Equipment used in personnel training and experiments related to organic chemistry, nutrition science, food hygiene, food preservation and processing, and microbiology</p>	<p>The following were classified as priority [C]</p> <p>Brabender visco amilograph, Excluder, Telephone extension system, etc.</p>	<ul style="list-style-type: none"> • Insufficient frequency of use; some items are judged as not being directly related to education.
<p>5. Dept. of Crop Science</p> <p>Equipment used in personnel training and experiments related to tissue culture, seed science, plant breeding, plant physiology, crop cultivation in general, and equipment for Dodangolla Experimental Farm</p>	<p>The following were classified as priority [C].</p> <p>Deep freezer, and Radio-isotope experimentation equipment.</p> <p>Irrigation equipment for Dodangolla Experimental Farm shall be a priority of this project</p>	<ul style="list-style-type: none"> • Joint use was judged possible. • Safety facility at the site was judged insufficient for radioisotope experiments. • It was found possible to include the irrigation equipment for Dodangolla Experimental Farm in this project

<p>6. Dept. of Animal Science</p> <p>Equipment used in personnel training and experiments in the field of animal nutrition, animal physiology, meat science, animal husbandry technology, and fishery.</p>	<p>The following were classified as priority [C].</p> <p>Hay Harvester, Hay Baler, Equipment for Radioisotopes, etc.</p>	<ul style="list-style-type: none"> • Too sophisticated, or necessity for education was judged insufficient. • Safety facility was judged insufficient for radioisotope experiments.
<p>7. Dept. of Agricultural Engineering</p> <p>Equipment used in personnel training and experiments in the field of postharvest processing, and machines used in the workshop (metal & wood).</p> <p>Equipment used in personnel training and farm management conducted at Meewatura Experiment Farm.</p>	<p>Equipment used in experiments of postharvest processing, electricity, workshop, and equipment used in training and farm management conducted at Meewatura Experimental Farm.</p>	<ul style="list-style-type: none"> • No changes was made to original request
<p>8. Dept. of Agricultural Extension</p> <p>AV. unit, FM radio broadcasting equipment, printing equipment, computers, and cars.</p>	<p>The following were classified as priority [C].</p> <p>FM radio broadcasting equipment, receiving apparatus for satellite broadcasting, color slide processor, color copying machine, car, video projector, etc.</p> <p>It was agreed that printing equipment and a video projector shall be supplied for common use by all departments in the Faculty of Agriculture.</p>	<ul style="list-style-type: none"> • Some pieces of equipment were judged as not being directly related to education. Joint use with other departments was judged possible for some equipment.
<p>9. Dept. of Agricultural Economics</p> <p>Printing equipment, car, computer, cleaning equipment, etc.</p>	<p>The following were classified as priority [C]. Car and printing equipment.</p>	<ul style="list-style-type: none"> • Joint use was judged practical.
<p>10. Library, Faculty of Agriculture</p>	<p>Computer for information on books, and audio-visual equipment for lecture hall.</p>	<ul style="list-style-type: none"> • Additional request
<p>11. Computer unit for students.</p>	<p>Computer unit for students.</p>	<ul style="list-style-type: none"> • Additional request
<p>12. Others</p>	<p>Mini-bus (20 passengers), and Audio-visual equipment for large lecture hall</p>	<ul style="list-style-type: none"> • Additional request

2-2-2 Basic Concept of the Project

This project plans to strengthen the educational activities of the Faculty of Agriculture, University of Peradeniya by improving the educational, training and research equipment used in the relevant facilities such as existing classrooms, laboratories, and farms. It aims at nurturing of agricultural specialists proficient in modern technology who are required for realizing national programs (14th 5-year Programme of Investment : 1993 ~ 1997) and also for realizing regional agricultural development and thereby strengthening the agricultural sector, which is the economic mainstay of the country.

The basic concept of the project is to replace the superannuated and worn-out existing equipment and that which is needed to accommodate present curriculums, and to increase the number of students and teaching staff. As to the equipment that newly supplied to the Faculty of Agriculture, top priority is placed on educational equipment compatible with the curriculums. Furthermore, minimum equipment necessary for experimentation and preparation of graduation theses by undergraduates shall also be included. However, such equipment for experiments and research work is not only expensive but also rather difficult to operate and maintain; therefore, equipment should be used jointly by multiple departments. Efficient utilization and maintenance shall be left to the responsibility of those departments who use the equipment. Attainment of the minimum quantity of equipment, instrumentation, and machinery necessary for education and research work by students and teaching staff shall be the objective of the project. Equipment shall include that for preparing educational materials, compiling research results, and publishing research achievements.

The projected equipment will be used by about 900 students and about 140 members of the teaching staff at the Faculty of Agriculture. In case of experiments for students, 40 ~ 50 students form one class although the exact number varies according to the department, course, and subject, etc. Experiments are conducted in groups which usually consist of 5 ~ 10 students, and sometimes of more than 20 students.

However, in addition to the increase in the number of students, the number of classes,

the number of groups, the number of students in one group have also increased recently, resulting in a decrease in the effectiveness of education and practical training. Therefore, the quantity of equipment shall be determined in consideration of the number of students and the contents of experiments according to the curriculum.

2-3 Basic Design

2-3-1 Design Concept

(1) Environmental conditions

Peradeniya, Kandy City, which is the site for this project, is situated at latitude 7° north which is in the tropical zone. Although the altitude is only approximately 500m above sea level, the average annual temperature is 24°C, and average relative humidity is 73%. The climate is warm and humid.

In this project, environmental conditions for operation of equipment in the laboratories shall be improved, although the basic system shall conform to the one presently practiced at University of Peradeniya. Specific measures are as follows;

- 1) Existing laboratories for tissue culture and microbiology research are partially air-conditioned and the rooms kept at approximately 20°C. The same conditions shall be applied in similar laboratories where equipment shall be installed under this project.
- 2) Air conditioners are also used in the computer room of the Faculty of Agriculture and the Faculty of Engineering. In the new facility where 25 units of computers for students will be installed under this project, the same conditions shall be applied.
- 3) In the laboratory which will house a High performance liquid chromatograph, Gas chromatograph and other instrumentation whose accuracy is influenced by surrounding environmental conditions, air conditioners shall be used to maintain uniform operating conditions. For other analyzing equipment, no special measures shall be taken to control the environment.

(2) Infrastructure

1) Electricity

This year electric supply was limited during many hours of the day for a long period of time due to abnormal weather, late rain and a labor strike by the electric corporation. Such shortage of electricity was the first in several decades. The operation record of the diesel power generating unit procured through British ODA in 1992 shows that it was operated for the first time in 1996. Since similar power shortages did not take place in other years, strengthening of power generation ability shall not be planned in this project. However, limited reinforcement of power generation shall be made with special equipment only for the case where there is a danger of the contents spoiling if power failure continues for a relatively long time, such as in the case of seed preservation in low-temperature cabinets.

In consideration of power failure interruptions that are scheduled and that abrupt power failure is not expected to continue for long, the generators shall be of the manual start type. On the other hand, the frequency of momentary power-failure is quite high, making UPS (Uninterrupted Power Source) necessary for equipment that contains memory chips.

2) Water

Hard water is supplied to the laboratories. Therefore, the water distillation unit shall be equipped with a water softener for pretreatment. Water supplied at the university is taken from the Mahaweli River, which crosses the university campus, and is processed at university's purification plant. The water quality is well controlled and reportedly there is no water contamination. Installation of a settling tank in the Faculty of Agriculture is judged unnecessary.

(3) Equipment Utilization

1) Utilization of Existing Equipment

Equipment that is operating now and is expected to operate soundly in the future is excluded from the objectives of this project.

2) Joint use

The following joint use is planned as feasible in consideration of the frequency of use, place of installation, organizational and expense sharing, consciousness on ownership.

① Interdepartmental joint use

	Agricultural Biology	Crop Science	Soil Science	Food Science
Amino acid analyzer	●			○
Gas Chromatograph	●		○	○
Porometer	●	○		

○: Department where equipment shall be installed

●: Other departments who shall use the equipment

② Joint use within one department (by inter-laboratory use)

• Department of Agricultural Biology

As to the equipment for low-temperature storage, one deep freezer shall be installed and jointly used by the laboratories of entomology and plant physiology with consideration for each purpose, temperature conditions and quantity of items to be stored.

③ Joint use by all departments of the Faculty of Agriculture

• Computers for students in each department majoring in certain subjects
Existing computers for students in each department shall be consolidated in one location and centrally controlled in order to maximize their utilization. New computers procured under this project shall be added in the form of reinforcement of present functions.

• Printing machine and its accessories

An offset printing machine and its accessories were installed in the Department of Agricultural Extension but were used by all departments of the Faculty of Agriculture. The machine to be procured under this project shall be placed in the common facility of the Faculty of Agriculture in order to make it clear that it is for the use of the entire Faculty of Agriculture.

3) Use of Substitutes

The methods of measuring or analysis, value or unit of indication, and accuracy can be changed, and substitute equipment are shown in the following table.

Request	Substitute
Dept. of Agricultural Biology Portable Photosynthesis meter Porometer Portable infrared gas analyzer Portable spectroradiometer Quantum radiometer / photometer	Portable infrared gas analyzer and Portable spectroradiometer are substituted by Portable Photosynthesis meter, Porometer, and Quantum radiometer / photometer (Porometer is equipped in the Dept. of Crop Science and cooperatively used with the Dept. of Agricultural Biology)
Dept. of Soil Science Automatic C analyzer Automatic N analyzer C / S analyzer Atomic Absorption Spectrophotometer Flamephotometer HPLC ICPA X-ray diffractometer	Automatic C analyzer is substituted by Automatic C / S analyzer Automatic N analyzer is substituted by Kieldahl unit. ICPA and X-ray diffractometer are substituted by Atomic Absorption Spectrophotometer and Flamephotometer

(4) Maintenance

1) Technical aspect

Most of the teaching staff have obtained degrees in technologically advanced countries and are acquainted with the use and maintenance of equipment similar to that included in this project. There should be no problem as far as the technical level is concerned.

In consideration of the good condition of existing equipment, technicians at the site are judged to be performing good maintenance work. Therefore, it is judged that technology necessary for conducting maintenance work could be learnt by local staff through technical explanation and guidance to be given by Japanese engineers before handover of the equipment.

2) Budgetary aspect

There seems no special problem, because the existing equipment is generally

well maintained. However, the following should be considered in selecting the equipment.

- the equipment should require minimal maintenance work.
- the most frequently replaced parts of the equipment should be easily procured in Sri Lanka.

Even if equipment is made in third countries, if it is procured in the markets of Sri Lanka and judged to be equal in quality and price to that made in Japan, in this project it shall be considered as being made in Sri Lanka because the maintenance work should be relatively easy.

(5) Scale and Grade of Equipment

The objective of assistance is the improvement of equipment for the undergraduate students of the Faculty of Agriculture, based on the present curriculum. The equipment for research work conducted by postgraduate students or teaching staff shall not be the objective of this project. The proper scale of equipment improvement shall be decided in consideration of the present number of students.

The exact quantity of equipment for this project shall be decided in consideration of the following conditions;

Condition 1. It shall be on a reasonable level according to different modes of use of different equipment for different modes of lectures, in consideration of the quantity and functions of existing equipment.

- ◇ There are the following four modes of equipment use, according to the different mode of lectures.
 - A. One set of equipment is used for the test / experiment for one class of students (including demonstration test).
 - B. Each student in the class uses one set of equipment to conduct test / experiment.
 - C. One class of students is divided into groups of proper size and each group

uses one set of equipment to conduct the test / experiment (including the cases where several teachers make demonstrations for one group; also cases where each student of third year or fourth year uses one set of equipment to conduct test / experiment for graduation report.)

- D. One class of students is divided into groups of proper size and each group uses a different set of equipment. All students in the class conduct all tests/experiments by rotation.

Note 1) Similar courses in the same department do not operate the same equipment simultaneously.

Note 2) [One class] means students who attend lectures at the same time.
[One course] means all the students who take the respective course.

Courses in the first year and second year are common and compulsory. 180~190 students will be attending lectures at one time. The practical lessons in this case are given to groups of 40~50 students according to the conditions of experiment facility. [One class] in this case means 40~50 students and [one course] in this case means 180~190 students.

Note 3) The quantity of equipment which shall be used in plural modes by different courses is decided according to the mode of use which requires the greatest quantity of equipment among above-mentioned A~D.

The quantity of equipment needed by above-mentioned modes of use A~D is calculated as follows:

- A: One set
- B: Equal to the number of students in the class.
- C: Equal to the number of groups.
- D: Number of groups divided by number of different kinds of experiments.

Condition 2 As to the equipment whose quantity is difficult to estimate according to the modes of use, approximate quantity is estimated according to the amount and content of work expected to be performed or the number of rooms where the equipment will be installed, and also in consideration of the quantity of existing equipment.

- E. Laboratory equipment, audio-visual equipment and equipment for making teaching materials are used in several courses and it is difficult to estimate the necessary quantity based solely on the number of users. Therefore, the necessary quantity shall be the number of laboratories or lecture rooms where the equipment will be installed or it shall be in proportion to the necessary amount of work expected to be performed.
- F. Quantity of some equipment for special experiment shall be set at an appropriate level in consideration of the quantity of existing equipment and according to the amount of work intended to be performed, which is derived from the number of samples or plots per experiment.

(6) Period of Project

In this project, all of the work shall be completed within a single year.

2-3-2 Basic Design

(1) General

In this project the equipment shall be installed at the existing facility belonging to the Faculty of Agriculture, University of Peradeniya situated in the suburb of Kandy City, central Sri Lanka. Equipment is to be installed at the eight departments, library, Meewatura Experimental Farm under Department of Agricultural Engineering, Mawela Livestock Field Station under Department of Animal Science, both of which are located on the campus of the Faculty of Agriculture, and Dodangolla Experimental Farm under Department of Crop Science, which is situated in Kundasale, about 20km east of the campus.

The conditions of these facilities and experimental farms are generally good. Partly worn facilities have been repaired under the University's budget for rehabilitation.

As to the equipment installation under this project, necessary facilities are well prepared except some partition walls, power sources that must be relocated, and water supply and sewage that must be provided in a few laboratories.

Uses of the equipment to be procured and installed under this project are categorized as below ①~④.

- ① Used in practice/experiments based on the curriculum.
- ② Used in the study for graduation theses along with research themes prepared by each Department.
- ③ Used for preparation of teaching materials, for reports / theses, and also for publication of research achievements.
- ④ Used for other general educational activities.

The relation of these uses with the curriculum and the equipment are shown in Figure 2-1 (1/7 ~ 7/7) for each Department (the Department of Agricultural Economics and Extension is omitted in the figure because the purpose of equipment use is clarified).

(2) Equipment Plan

Table 2-2 shows the concept plan of the equipment quantity, approximate specifications, etc. The method for determining the quantity of equipment and approximate specifications is also shown in Table 2-2. [A~F] in the table shows that the method of determining quantity is in accordance with the content of [2-3-1 Design Concept, (5) Concept for Scale and Grade of Equipment].

(3) Drawings

Layout plans for the facilities at the Faculty of Agriculture are shown in Figure 2-2 and Equipment Layout Plans for each laboratory are shown in Figure 2-3 (1/10~10/10).

Curriculums for undergraduate of the department														
Course	(Course No.)	Lecture (hr)	Practice (hr)	No. of student	Course	(Course No.)	Lecture (hr)	Practice (hr)	No. of student	Course	(Course No.)	Lecture (hr)	Practice (hr)	No. of student
The first year														
Principle of Agronomy	(CS1101)	30	20	185	Quantitative of Crop Physiology	(CS3107)	30	-	23	Multivariate Analysis	(CS3308)	30	-	17
Principle of Horticulture	(CS1102)	30	20	185	Crop Science I (Field Crop)	(CS3106)	30	-	32	Micro-Meteorology	(CS3309)	20	-	-
Statistical Methods	(CS1201)	20	20	185	Crop Science II (Legumes)	(CS3201)	20	-	139	Sampling Techniques	(CS3310)	20	-	-
Mathematics II	(CS1202)	30	-	185	Vegetable Crop Production	(CS3202)	20	-	22	The Fourth Year				
Principle of Horticulture II	(CS1301)	20	-	185	Post Harvest Physiology	(CS3203)	20	-	30	Farming System	(CS4101)	20	-	113
The second year					Crop Experimentation	(CS3204)	30	-	43	Seed Physiology	(CS4102)	20	-	28
Plantation Crop Production	(CS2301)	15	10	185	Principles of Forest Management	(CS3106)	30	-	10	Landscape Horticulture	(CS4103)	20	-	25
Farm Practice Course I	(CS2101)	30	60	185	Horticulture	(CS3207)	20	20	23	Perennial Crop Production II (Export Crop)	(CS4104)	20	-	95
Farm Practice Course II	(CS2501)	30	60	185	Field Crop Production III (Cash crop)	(CS3301)	20	-	143	Integrated Silviculture	(CS4105)	30	-	6
The third year					Fruit Culture	(CS3302)	20	-	19	Horticultural Crop Production Seminar	(CS4106)	30	-	62
Field Crop Production I (Cereal)	(CS3101)	30	-	77	Cut Flower Production	(CS3303)	20	-	15	Research Project		-	-	48
Plant Tissue Culture	(CS3102)	20	20	36	Perennial Crop Production II (Rubber)	(CS3304)	30	-	29					
Perennial Crop Production I (Coconut)	(CS3103)	20	0	185	Statistical Methods III	(CS3305)	30	-	5					
Principles of Forest Ecology	(CS3104)	20	20	46	Silviculture	(CS3306)	30	-	8					
Statistical Methods II	(CS3105)	30	-	185	Crop Science III (Plantation Crops)	(CS3307)	30	-	15					

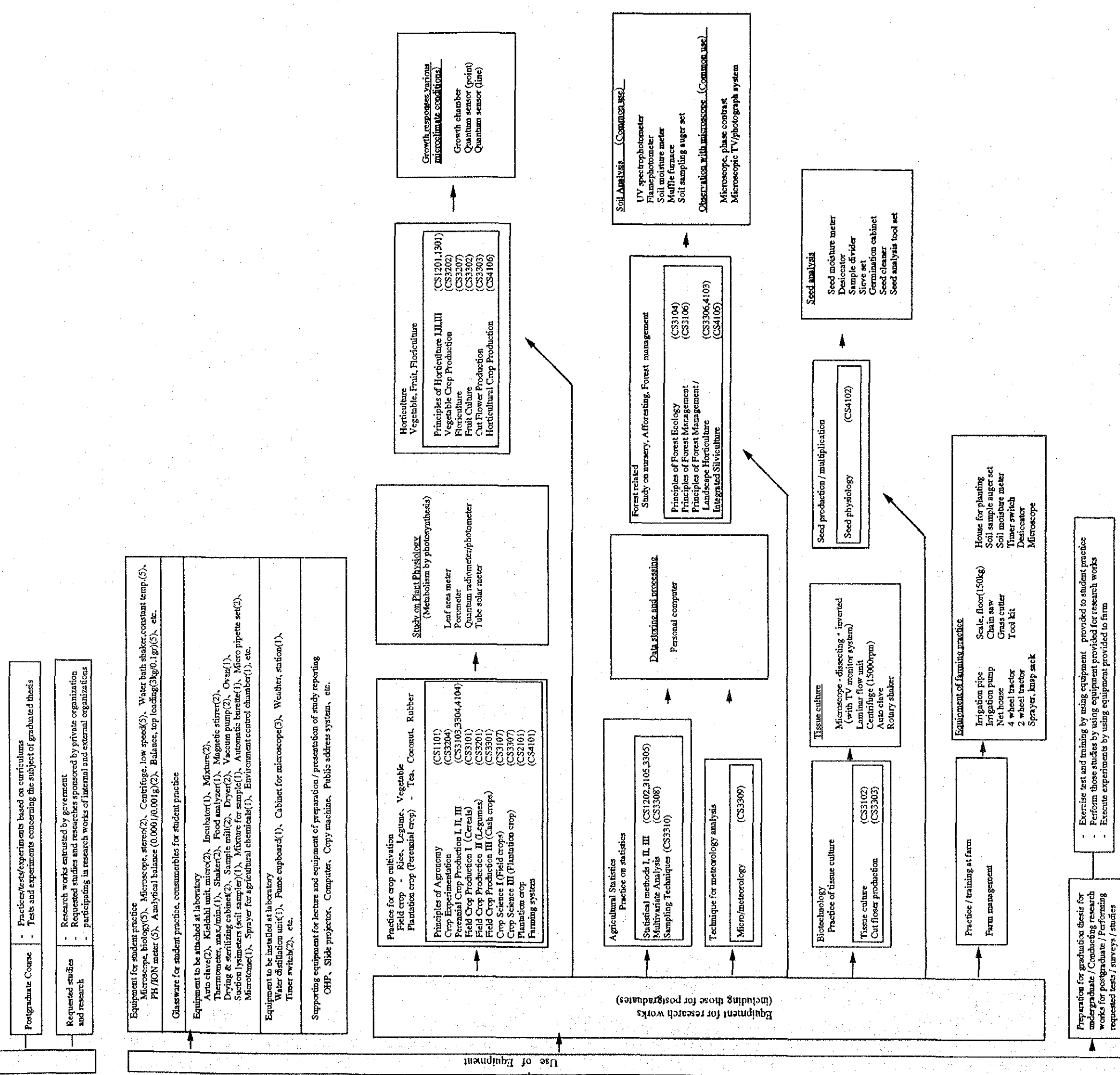


Fig. 2-1 Relation between the Activities and Equipment planned (2 / 7 Dept. of Crop Science)

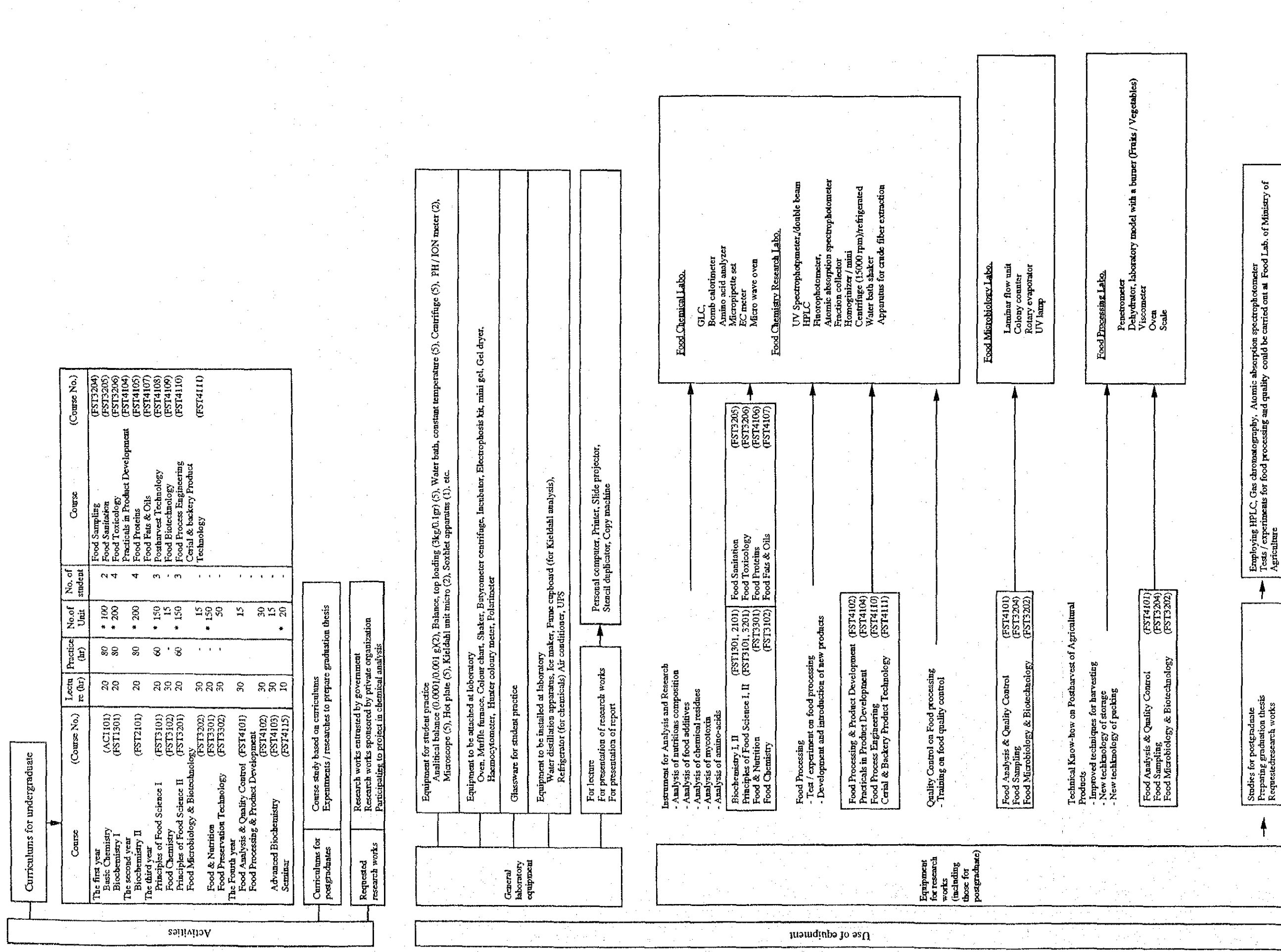


Fig. 2-1 Relation to the Activities of the Department and Equipment Planned (3 / 7 Dept. of Food Science & Technology)

Curriculums for undergraduate		Curriculums for postgraduate		Curriculums for postgraduate		Curriculums for postgraduate		Curriculums for postgraduate		Curriculums for postgraduate	
Course	(Course No.)	Lecture (hr)	Practice (hr)	No. of student	Course	(Course No.)	Lecture (hr)	Practice (hr)	No. of student	Course	(Course No.)
The first year	Poultry Management (AS1101)	10	20	181	The third year	Anatomy & Physiology (AS2202)	24	4	37	The Fourth year	Animal Genetics & Breeding (AS4101)
	Agrozoology (AS1202)	14	4	172		Meat Science (AS2203)	15	10	35		Marine Fisheries (AS4102)
	Ruminant Management (AS1301)	15	10	172		Dairy Technology (AS2204)	15	10	35		Advanced Ruminant Nutrition (AS4103)
The second year	Ruminant Management (AS2101)	11	6	178		Biology of Nutrition (AS2205)	20	-	35		Seminar (AS4104)
	Practical Animal Production I (AS2201)	-	-	178		Aquaculture I (AS2206)	15	2	25		Recent Advancement in Animal Production (AS4105)
	Practical Animal Production II (AS2301)	-	-	178		Growth of Farm Animals (AS2207)	16	2	20		Livestock Economics (AS4106)
The third year	Animal Nutrition I (Monogastric Nutrition) (AS3101)	30	-	37		Reprod. & Lactation Physiology (AS3301)	-	-	20		
	Animal Health & Hygiene (AS3102)	15	10	37		Advanced Monogastric Nutrition (AS3302)	-	-	32		
	Forage Management (AS3103)	5	10	20		Livestock Integrated System (AS3303)	-	-	10		
	Poultry & Egg Production (AS3104)	5	10	20		Microlivestock Production (AS3304)	-	-	-		
	Animal Nutrition II (Ruminant Nutrition) (AS3201)	30	-	37		Advanced Fisheries & Aquaculture II (AS3305)	-	-	-		

Curriculums for postgraduate Practices based upon curriculums of postgraduate Experiments for graduation thesis

Research works requested from public and private organizations by contracting basis, Participating to the project executed by external organization

Equipment for student practice
Microscope, biological student(3), Microscope dissecting, student(5), PH meter(3), Oven(3), Water bath, Constant temperature(2), Analytical balance (0.0001/0.001 g(2)), Balance, top loading (3kg/0.1gr)(4), etc.

Models for animal anatomy (Cattle, Pig, Poultry, Rabbit, Sheep, etc.), Artificial udder (3)

General equipment for practice
Incubator(2), Thermometer, digital (1), Mill, sample (2), Vacuum pump(2), Thermohygraph (1), Water bath shaker, constant temperature(2), Oil bath (1), etc.

Equipment to be installed at laboratory
Microscopic photo system (1), Microscopic TV system (1), Water distillation unit (2), Air conditioner (for close analysis)(2), Refrigerator (for chemicals) (2), Fume cupboard (2), etc.

Glassware for student practice

Consumables for student practice

Equipment for lecture, preparation of report and presentation
OHP, Slide projector, Public address system, etc.

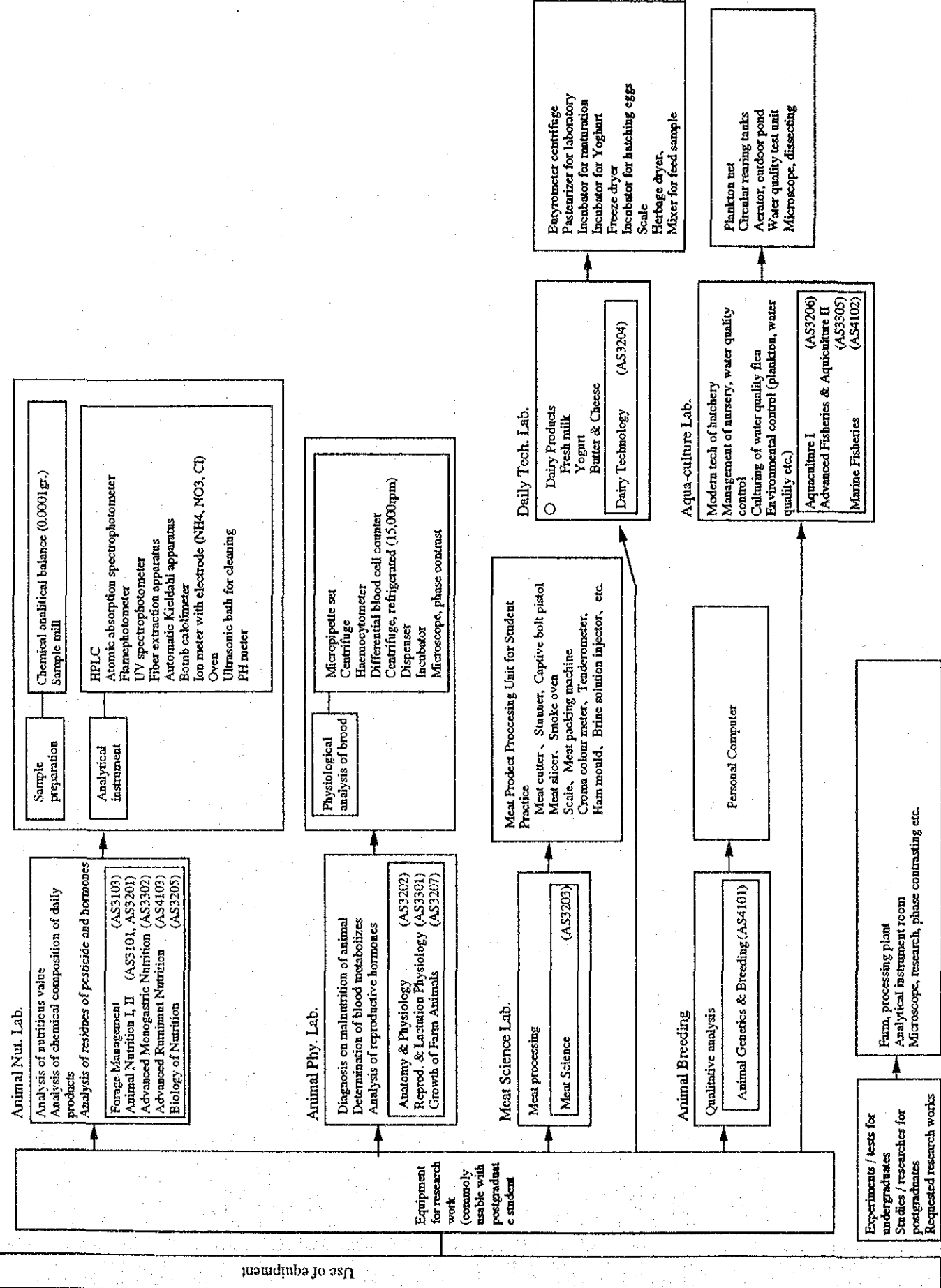
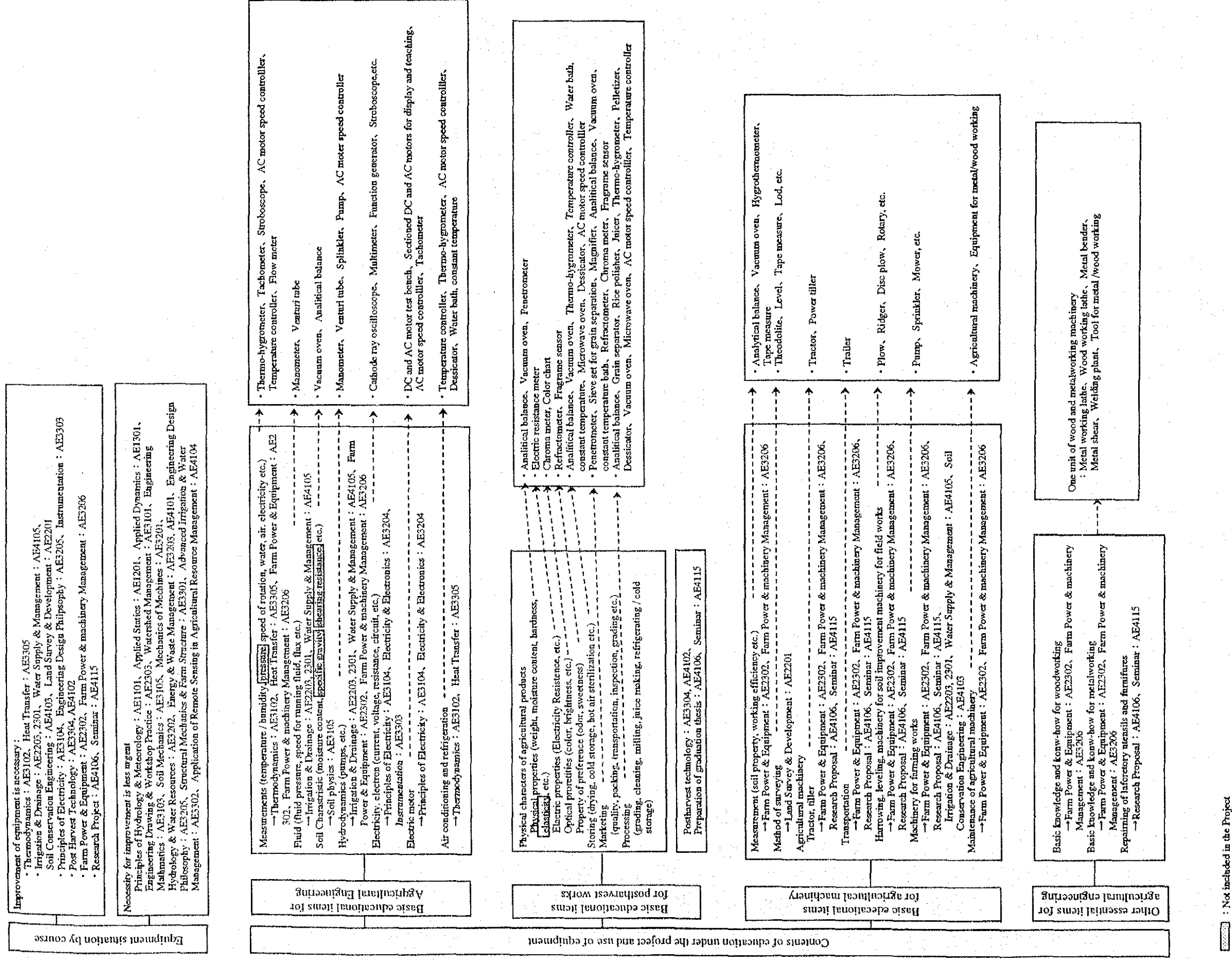


Fig. 2-1 Relation to the Activities of the Department and Equipment Planned (4 / 7 Dept. of Animal Science)



□ : Not included in the Project

Fig. 2-1 Relation to the Activities of the Department and Equipment Planned (5 / 7 Dept. of Agricultural Engineering)

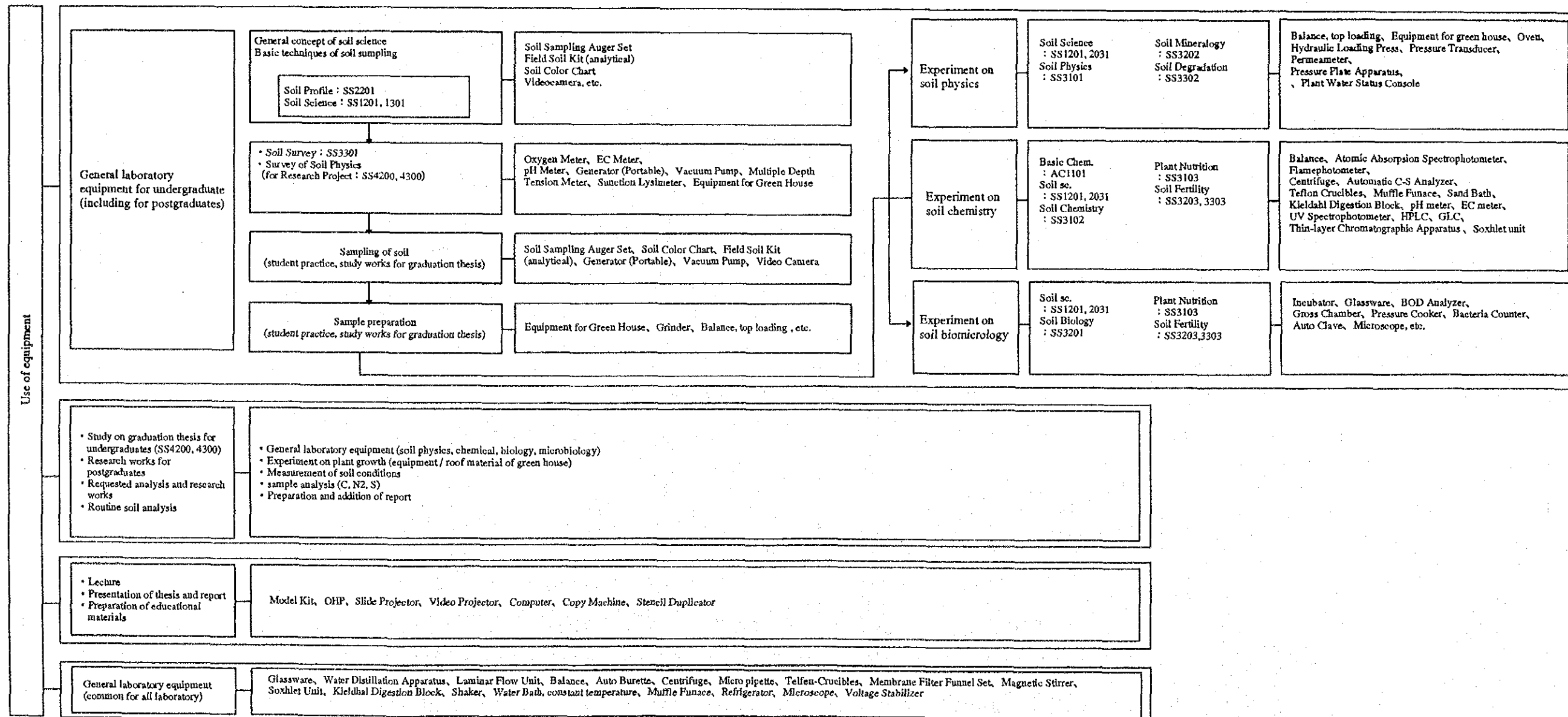
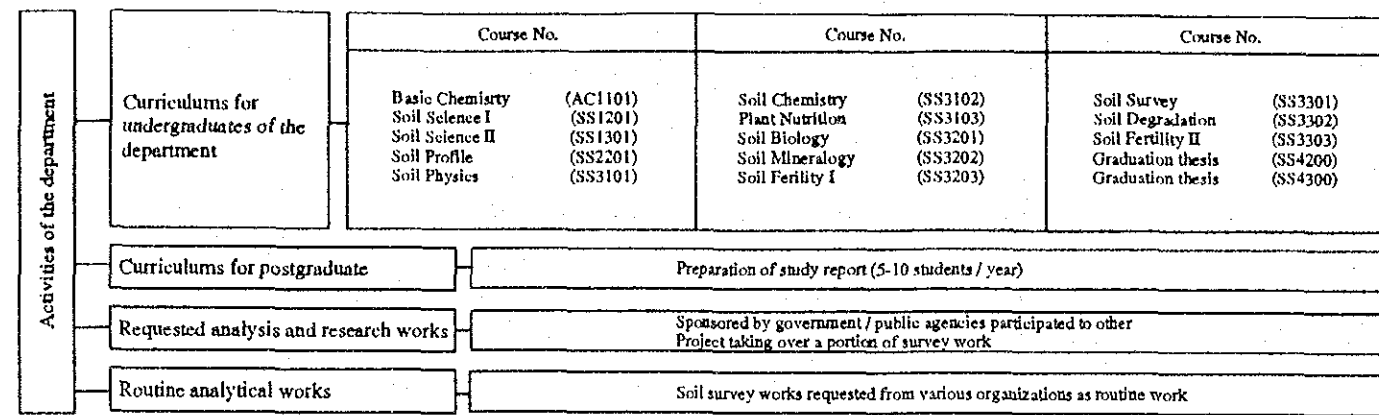


Fig. 2-1 Relation to the Activities of the Department and Equipment Planned (6 / 7 Dept. of Soil Science)

Activity		Courses			Courses			
		Lecture Hours	Practice Hours	Nos. of Student	Lecture Hours	Practice Hours	Nos. of Student	
for Undergraduate Student	Principles of Human Behavior (AEX1011)	15	10	185	Social Science Research Methods (AEX3303)	25	10	20
	Agric. Economics and Extension (AEX2201)	20	40	180	Introductory Agricultural Sociology (AEX3305)	25	0	6
	Introductory Agricultural Education (AEX3101)	25	10	8	Public Relations (AEX3308)	15	10	15
	Introductory Rural Sociology (AEX3104)	20	10	10	Agricultural Extension (AEX4103)	18	4	160
	Introduction to Extension Education (AEX3105)	25	10	25	Rural Development (AEX4105)	30	0	12
	Organizational Management (AEX3203)	30	20	20	Agricultural Journalism (AEX4106)	25	10	12
	Program Development (AEX3204)	30	0	20	Research Proposal (AEX4107)	20	0	210
Basic Communication (AEX3205)	25	10	25	Seminar (AEX4108)	5	10	13	
				Research Project (AEX4200) (AEX4300)				
for Postgraduate Student	Courses and Research							
Services for other department	Video/Photo shooting and editing, PC data and Slide Film processing, etc.							

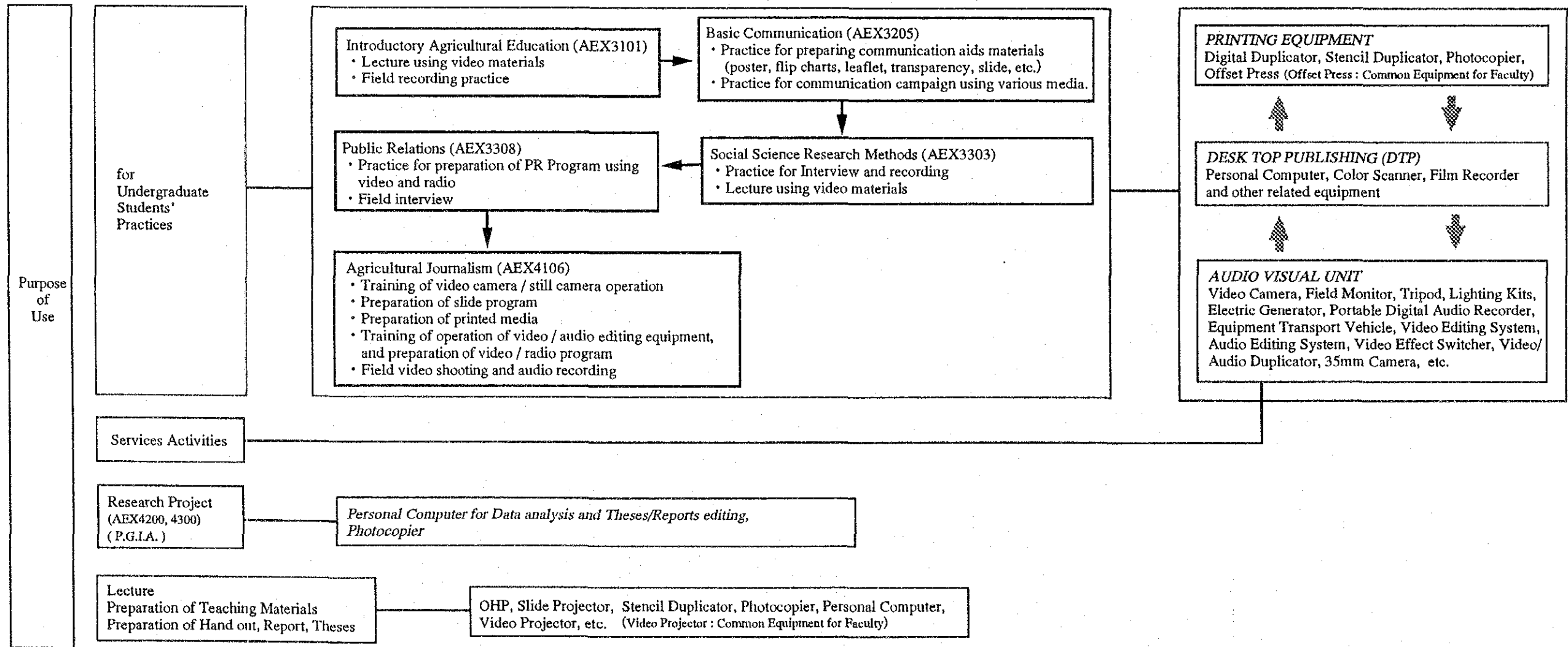


Fig. 2-1 Relation between the Activities and Equipment (7/7 Dept. of Agri. Extension)

Table 2-2 Equipment Plan

No.	Equipment	Quantity	Purpose and specification	Criteria	Newly placed	Replaced	Supplemented	Joint use	Department
Department of Agricultural Biology									
1	PCR reactor	1 unit	FOR the course of 'Molecular Genetics' and 'Molecular Biology Technique' to identify specific strains of pathogen using DNA sequence and PCR probe. W/ necessary pipettes and chips.	A	○			○	AB
2	Bio-image system	1 unit	For analyzing DNA fragment, protein band pattern, 2-D spot pattern. Simple unit working with personal computer, 207 MB, RAM 12MB, printer, color monitor and software.	A	○			○	AB
3	Centrifuge, refrigerated	1 unit	For the course of 'Plant Physiology' and 'Molecular Genetics', 20,000 rpm, 2 sets of rotors and tubes.	A	○			○	AB
4	Deep freezer	1 unit	For preservation of sensitive bio-material such as enzyme, generator attached.	E	○			○	AB
5	UV spectrophotometer	1 unit	For the course of 'Plant Physiology' to determine qualitative and quantitative element of plant. Wavelength: 200~1100nm optical bandwidth: 5nm, Photometric range: 0.3 to 3 ABS.	A		○		○	AB
6	Microplate reader	1 unit	For the course of 'Plant Pathology' and 'Epidemiology' to conduct ELISA test for identification of epidemics, disease and infection rate and etc. Wave range 400~700nm, with plate mixer and pipettes.	A	○			○	AB
7	Laminar flow unit	2 units	For the Plant pathology experiment to minimize the risk of external contamination and cross-contamination. Width:1300mm, UV lamp, LPG burner, vertical airflow with 0.3 m/sec	E	○				
8	Auto Clave	2 units	For the 'Plant pathology lab.' and 'Micro organism lab.' to sterilize glassware and instrument. Working volume:40L, temperature:60~120°C	E		○			
9	Fume cupboard	2 units	For the 'Plant pathology lab. Internal width 1000 x 600 mm, W/exhaust fan, gas cock, waterfaucet	E		○			
10	Microscope, phase contrasting, research	1 unit	Commonly used for research works to observe micro-organism. trinocular, magnification: 40x~1000x, 6V 30watt halogen lamp	A		○		○	AB
11	Photosynthesis meter, portable	1 unit	Commonly used in the department to study photosynthesis phenomena of plant. Portable, NDIR system, measurement range: 0~3000ppm, mol ¹ (CO ₂), 0~75 m mol mol ¹ (water vapor)	A	○			○	AB
12	Quantum / Radiometer / Photometer	1 unit	Commonly used in the department for measurement of ray beam, reflection of light. Quantum (μ mol/㎡/s), radiometer(w/㎡), photometer (lux)	A		○		○	AB
13	Microscope, Biology	10 units	For student practice to analyze histological tissue. Binocular, plain stage, eyepiece: 10x, 15x, objectives 4x, 10x, 60x with halogen illumination	C			○	○	AB
14	Microscope, stereo	10 units	For student practice to observe natural micro organism such as damages caused by insects, pests and disease. Binocular, total magnification 10x~30x, illumination 100 v 20watt	C			○	○	AB
15	Incubator for insect culturing	6 units	For the course of 'Insect Ecology & Behavior' to observe metamorphosis phenomena and experiment of culturing with artificial feed. Capacity:150L, inner material: stainless steel	C		○			
16	Insect collecting lamp	1 unit	For the field training in the course of 'Insect collection and identification'	A		○			
17	Electroporator with cuvette	1 unit	For the course of 'Molecular Genetics', 'Recombination DNA technology' and 'Cytogenetics'	A	○				
18	Food analyzer	1 unit	For the course of 'Plant physiology' to measure glutamic acid (1.5~20mg/100L), vitamin C (1~1000mg/100ml) and sugar/alcohol (0~6%)	A		○		○	AB
19	Centrifuge	4 units	Commonly used in the laboratory. Low speed (5000rpm), 15ml x 32pcs, 2sets of rotor	C		○			AB
20	Oven	6 units	For drying sample and laboratory instrument	C			○	○	AB
21	Desiccator, cabinet type	4 units	For storing microscopes to prevent them from damage by propagation of fungus. 550L	C			○	○	AB
Department of Animal Science									
1	Bomb calorimeter	1 unit	For the course of 'Animal Nutrition' to test nutrient value of feed nutrition. Capacity: 300CC, Pressure resistance: 200 kg/㎡	A		○			AS
2	UV spectrophotometer	1 unit	For the course of 'Forage management' and 'Animal Physiology' to conduct qualitative / quantitative analysis of ingredient of feed / dairy product. Waverange: 325~1100 nm	A		○			
3	Automatic Kieldahl apparatus	1 unit	For the course of 'Animal Nutrition' to determine nitroge/protein contents in feed / dairy product. 20 samples/hr, total nitrogen per sample: 160 mg, 420°C for heating	A		○			
4	Fiber extraction apparatus	1 unit	For the course of 'Animal Nutrition' to analyze fiber content in feed material. 6 samples/test, sample: 0.5~3g, Weende (crude fiber) procedure system applied.	A		○			
5	Flame photometer	1 unit	For routine work on analysis Na, Ca, Li in feed and dairy products in the course of 'Animal Nutrition'. Measuring range: 10~200ppm, with filters	A	○				
6	HPLC	1 unit	For the course of 'Animal Nutrition' to analyze feed nutrition, blood metabolite, and milk / meat / fish composition. Detector: UV-VIS/RID, capillary, low pressure gradient system	A	○				
7	Fume Cupboard	2 units	Used for 'Kieldahl analysis' for giving protection of air contaminant. Width: 1200 mm, W/fan, gas cock, waterfaucet	E		○			

No.	Equipment	Quantity	Purpose and specification	Criteria	Newly placed	Replaced	Supple mented	Joint use	Department
8	Microscope, phase contrasting	1 unit	For the course of 'Animal Physiology' to observe live animal tissue. head, magnification: 50x ~ 1000x, 6V30watt halogen illumination, phase contracting attachment	A		○			AS
9	Differential blood cell counter	1 unit	For the course of 'Animal physiology' to count blood cell. Neubauer system, semi-automatic	A		○			
10	Incubator for Yogurt	1 unit	For the course of 'Dairy Technology'. Temp.: ambient ~65°C, 900L.	E					
11	Incubator for maturation of dairy products	1 unit	For the course of 'Dairy Technology', temp.: +5°C~65°C, 900L.	E		○			
12	Freeze dryer	1 unit	For the course of 'Dairy Technology'. Laboratory use, cold trap temp.: -45°C, cold trap capacity: max. 4 L/hatch, vacuum pump: 100/120L/min.	E	○				
13	Pasteurizer for laboratory	1 unit	For the course of 'Dairy Technology' to pasteurize fresh milk. Laboratory use, working temp. 85°C	A	○				
14	Meat product processing unit	1 unit	For student practice of meat processing in the course of 'Meat Science'. Component: Stunner, Captive bolt pistol, Meat saw, Meat slicer, Weigher and etc.	A	○		○		
15	Farm animal model	1 lot	For student training of animal anatomy in the course of 'Animal Management'. One set of cow, pig, poultry, rabbit, fish, sheep	A			○		
16	Herbage dryer	1 unit	For the course of 'Animal nutrition' to dry glass, feed grain. Forced convection, 500L/time, max. temp. 220°C	A		○			
17	Centrifuge, refrigerated	2 units	Commonly used in the laboratory. 15000rpm, -20°C~40°C,	A					AS
18	Atomic absorption spectrophotometer	1 unit	For the course of 'Animal Nutrition' and 'Dairy Technology' to analyze trace element in feed, milk, meat and blood. Programming system, flame controlled.	A	○				
19	Water distillation unit	2 units	Commonly used in the laboratory. Distillation → ion exchange → filtration, Capacity: 1.8L.	E				○	AS
20	Ion meter with electrode	1 unit	Commonly used in the laboratory. Table top type, measuring range: 0.1~1000mg/L, sensor: PH, NH ₄ , NO ₃ , Cl	A		○			AS
21	Water quality meter	1 unit	Used for Aqua-culture to check quality of water. Test item: PH, O ₂ , temperature, DO, NH ₄ , EC, Nitrous acid, hardness and color	A		○			
22	Bytrometer centrifuge	1 unit	For the course of 'Dairy Technology'. 1000~5000rpm, max. force: 630g	A		○			
23	Microscope, Biological, for student	3 units	For practice. Binocular, eyepiece:10x, objectives: 4x~40x, with illumination	E			○	○	AS
24	Chroma meter	1 unit	For the course of 'Meat science' to test meat quality (freshness), Probe: φ 8mm	A		○			
25	Tenderometer	1 unit	For the course of 'Meat Science' and 'Dairy Technology' to test hardness, elasticity and penetration of animal products, measuring range: 2KN~600KN (450~13500lbf)	A	○				
26	Circular rearing tank	10 units	Use for Aqua-culture for hatchery purpose. 500L~1000L, FRP type	F			○		
27	Dryer	3 units	Commonly used in the laboratory for sample preparation. Convection: natural air	A		○			
28	Glassware	1 lot	Commonly used in the laboratory	C			○		
Department of Crop Science									
1	Flame photometer	1 unit	For the course of 'Crop Science' and 'Field Crop Production'. Measuring range: 3~100ppm, w/filters for K, Ca and Mg	A	○				
2	UV spectrophotometer	1 unit	For the course of 'Crop Science' to evaluate P content of soil under different crops and conditions. UV/double scanning, measuring range: 200~1100nm, band width: 5nm	A					
3	Environmental control chamber	1 unit	Used for experiment to grow plant under controlled environment to monitor their growth responses to various micro climate and soil. Spec: 5~45°C ± 1°C, 50~90% RH, 800 x 800 x 1500mm, 2 chambers, Max. of lux: 35,000	F	○				
4	Porometer	1 unit	For the course of 'Crop physiology' and 'Biometrical analysis' to measure photosynthesis of plant at different conditions. Measuring range: 0.5~30scm ⁻¹	A	○			○	CS, AS
5	Fume cupboard	1 unit	Used for Kieldahl test at 'Student laboratory'. 1500mm width, w/fan, gas cock, waterfaucet	E		○			
6	Leaf area meter	1 unit	Commonly used in the laboratory to measure leaf area such as damage portion by insect, drought, air contamination and etc. Portable, measuring range: 9999.99cm ² , effective area width 100mm, thickness: 10mm	A		○		○	CS, AS
7	Kieldahl unit	2 units	Commonly used in the laboratory to analysis N content of soil, green manure and etc. Number of beaker: 8, max. temp. Digestion temperature: 420°C	C		○			CS
8	Germination cabinet	1 unit	For the course of 'Seed physiology' to test germination capacity and viability. Temperature & light control, 50°C, 90R/H, 400L.	A		○			
9	Fume cupboard	1 unit	Used for Kieldahl test at 'Research lab.'. 1500mm width, w/fan, with 10 m duct	E					
10	Laminar flow unit	1 unit	Used for tissue culture of plants. 1300mm width, UV lamp, LPG gas burner, vertical air type	A			○		
11	Microscope, dissecting, research	1 unit	Used for tissue culture of plants for dissecting. Trinocular, 40x~1000x, with illumination	A			○		CS
12	Weather, station	1 unit	Used for collection of meteorological data such as continuous graphical record of rainfall and temperature, digital anemometer, barometer, soil thermometer etc.	E					
13	Pump, deep well	1 unit	Equipped in deep well at Dodangolla Farm to make irrigation during dry season. Total lifting: 80m	E	○				
14	Pump, water pipe	1 unit	#	E	○				

No.	Equipment	Quantity	Purpose and specification	Criteria	Newly placed	Replaced	Supplemented	Joint use	Department
15	Tractor, 4 wheel	1 set	Placing at Dodangolla Farm for student practice and various farm operation. 35~40HP, with trailer, disk tiller, etc.	E		○			
16	Tractor, 2 wheel	1 set	Placing at Dodangolla Farm. 10~12HP, with trailer, rotary tiller, etc.	E		○			
17	Net house	1 lot	Placing at Dodangolla Farm for student experiment. 9 x 15 m, iron frame, glass roof	E		○			
18	Tank for water tower	1 unit	Used for net house irrigation. capacity: 2000 L	E	○				
19	Tube solar meter	2 units	Used for measurement of solar energy interception in crops. Large and small tube solar meter microvolt integrator. Power: 15.0 mv per kw-m ²	A				○	CS
20	Centrifuge, refrigerated	1 unit	Used for separation of bio-materials. Refrigerator (-20~40°C), 15000 rpm	A				○	CS
21	Auto Clave	2 units	Used for Tissue culture. Working temp.: 80~127°C, max. pressure: 1.6 kg/cm ² . Capacity: 32L	A	○				
22	Seed cleaner	1 unit	Used for student practice of seed cleaning in the course of 'Seed Production'. 2 stage of screen, air controlled	A		○			CS
23	Microscope, biology, student	5 units	For student practice, eyepiece 4x~60x, Objective 10x binocular, illumination built-in	B			○		CS
24	Centrifuge	5 units	Commonly used in the laboratory, table-top, max. 6000rpm, force: 4830g, inner capacity: 1000cc	B		○			CS
25	Food analyzer	1 unit	Used for test of photosynthesis of plant. Measuring range: glutamic acid 1.5~20mg/100L, Vitamin C: 1000mg/100ml, Sugar / alcohol: 0~6%	A	○				CS
Department of Food Science & Technology									
1	Bomb calorimeter	1 unit	For the course of 'Basic Chemistry', 'Food Chemistry' and 'Food Nutrition' to measure calorific value of food. Capacity: 300cc, mix pressure: 200kg/cm ²	A		○			FST
2	Amino acid analyzer	1 unit	For the course of 'Food Chemistry', 'Food Nutrition' and 'Food Proteins'. Main amino acid: Lysine, Methionine, Cystine, Tryptophan, Glutamic acid	A	○			○	FST, AB
3	Gas chromatograph	1 unit	For the course of 'Biochemistry' to analysis pesticide residues and antioxidants in food. Detector: TCD/FID, packed column	A		○		○	FST, AB, AS
4	Dehydrator, Laboratory model, with a burner (fruits/vegetables)	1 unit	For the course of 'Postharvest technology' and 'Food Process Engineering'. Max. temp.: 170°C, air forced by convection, water reduction rate 0.5~3%/hr, capacity: 500L	A	○				
5	Fluorophotometer	1 unit	For the course of 'Food Nutrition' and 'Food Toxicology' to analyze histamine and aflatoxin. Measuring range: 220~750 nm	A		○			FST
6	Fraction collector	1 unit	For the course of 'Biochemical' as accessory equipment of TLC and HPLC for continuous collection of eluates. Number of tube: 100~150, speed: 0.3 sec., temp.: 0~40°C	A					FST
7	UV spectrophotometer, double beam	1 unit	Used in the course of 'Biochemistry' and 'Food Nutrition' to analyze vitamins (A, C), enzymes, pigments, nitrogenous compounds. Measuring range: 200~1100nm, accuracy: ±0.5nm	A		○			FST
8	Apparatus for crude fiber	1 unit	Used for student practice in the course of 'Biochemistry' and 'Food Nutrition' to analysis fiber content in plant and food. number of flask: 6/time, sample per test: 0.5~3g, weende system	A	○				FST
9	Atomic absorption spectrophotometer	1 unit	For the course of 'Biochemical' and 'Food Nutrition' for quantification of minerals (Ca, Mg, K, Na, Fe), trace elements (Cu, Hg). Measuring range: 190~900nm, with auto sampler and lamp	A		○			FST
10	HPLC	1 unit	For the course of 'Biochemical' and 'Food Nutrition' to quantify sugar, vitamins, food flavors, food toxin and food additives. Detector: UV-VIS/RID, low pressure gradient system	A		○			FST
11	UPS, 2KVA	2 units	Attaching to sophisticated electric analyzer to protect it from sudden power failure.	E	○				
12	Rotary evaporator	2 units	Commonly used in the laboratory. Consisting bath temperature, motor rotation, timer, number of revolutions: about 15~190rpm, operating temp.: 5~35°C, flask capacity: 1L	E		○			FST
13	Water distillation unit	2 units	Commonly used in the laboratory. System: distillation → ion exchange → filtration, capacity: about 1.8L/hr	E			○		FST
14	Refrigerator	3 units	Common use for storing chemicals. 2~14°C, refrigerating: 250w, capacity: 500L	E	○				
15	Centrifuge, refrigerated	1 unit	Commonly used in the laboratory to separate sample of bio-materials. Working temp.: -20~40°C, about 15,000rpm	A			○		FST
16	Kjeldahl unit, micro	2 units	Used for student practice of quantification of nitrogen/protein. 6 holes, max. temp.: 420°C	E					FST
17	Hunter calorimeter	1 unit	Used for student practice of postharvest study of agricultural product. Color filter 3 kind/blue, green, brown	A	○				
18	Microscope, biological, student	5 units	Used for student practice of observing micro-organism of plant. Binocular, eyepiece: 4x~60x, objectives 10x, illumination built-in	C			○		FST
19	Centrifuge	5 units	Used for student experiment for sample preparation. Table top type, max. speed: 6000 rpm, capacity: 1000cc	C			○		FST
20	Fume cupboard	2 units	Used for Kjeldahl analysis. Width: 1200mm, fan, w/ gas cock, waterfaucet	E		○			
21	Butyrometer centrifuge	2 units	Used for quality test of fresh milk in student practice. Max. speed: 1500 rpm, max. force: 630 g	E		○			
Department of Soil Science									
1	Atomic absorption spectrophotometer	1 unit	For the course of 'Soil Chemistry' and 'Soil Survey' to quantify pesticide residue, micro nutrients and metallic elements in plant, soil and water.	A		○		○	SS

No.	Equipment	Quantity	Purpose and specification	Criteria	Newly placed	Replaced	Supplemented	Joint use	Department
2	Auto analyzer	1 unit	For the course of 'Soil Survey' to determine soil elements especially K ₂ O, CaO, SPAD system	A	○			○	SS
3	Automatic titor (potentiograph)	2 units	Commonly used in the laboratory. Detection range: electric potential 0~±2000mv, PH: 0~14, current: 0~±200, temp. :-170°C~+500	E		○		○	SS
4	Centrifuge	1 unit	Commonly used in the laboratory. rotation speed: about 1000 rpm w/tubes	A		○			
5	Aggregate stability set	1 unit	For the course of 'Soil Physics' to determine soil aggregate. Conducting in water tank (1850 x 360 mm 4 pcs), w/sieve set (150 φ x 45 mm 4 sets of 5 sieves)	A	○				
6	Rotary evaporator	2 units	Commonly used in the laboratory. standard type, circulation aspirator, cooling water by thermostat.	E		○		○	SS
7	Laminar flow unit	1 unit	Used for soil microbiological study to protect contamination. 1200 width, w/UV lamp, burner and air supply blower	A	○			○	SS
8	Flamephotometer	1 unit	Used for soil survey to determine qualitative content of Na, Ca and other alkali metal elements.	A	○			○	SS
9	Automatic C-S analyzer	1 unit	For the course of 'Soil chemistry' and 'Soil Survey' to determine content of C and S.	A	○			○	SS
10	Permeameter	1 unit	Used for soil survey to analyze water retentivity of soil. Portable and upright type, sample cylinder: 2.5L	A		○			
11	HPLC	1 unit	Used for quantitative analysis of organic substances, metallic ion and pesticide residue in soil. Detector: UV-VIS/RID, low pressure gradient system, w/3 kind column.	A	○			○	SS
12	Kjeldhal digestion block w/tubes	1 unit	For experiment of 'Plant Nutrition' and 'Soil Fertility' to qualify nitrogen / protein content in plant/ soil. Table-top model, 12 flasks (500 ml)	A		○		○	SS
13	Pressure plate apparatus (complete w/compressor)	1 unit	For experiment of 'Soil Physics' to determine soil water retention and suction. capacity: 4 plate cells, Pressure : 0~5 bars (75 lbf/in ²)	A		○			
14	Plant water status console	1 unit	For experiment of 'Plant Nutrition', table top model, capacity: 75 φ x 160L, w/compressor	A		○			
15	Oven, large	1 unit	Commonly used in the laboratory. Dimension (inner): 1200 x 800 x 600~800mm working temp.: 5~70°C	A		○		○	SS
16	Gas chromatograph	1 unit	Used for quantitative analysis of pesticide residues in soil applying to 'Plant Nutrition' and 'Soil Survey'. Detector: TCD/FID, packed column	A	○			○	SS
17	Glassware	1 lot	For student practice of 'Basic Chemistry'. One lot	C			○	○	SS
18	Glassware for microbiology lab.	1 lot	For student practice at microbiology laboratory.	C			○		
19	Fume unit	2 units	Placed at Kjeldahl room. 1200 mm and 1800 mm width, w/fan, gas cock, waterfaucet.	E		○		○	SS
20	Microscope, biological, student	3 units	For student practice to observe the structure of soil. Binocular (2 sets), trinocular (1 set w/camera)	E			○	○	SS
21	Sokhlet unit	1 unit	Used as experimental equipment for the continuous extraction of fat and oil. No. of hotplates: 6, w/Sokhlet glass ports	A					
22	Suction lysimeters (soil sampler)	6 units	For soil sampling in student practice. Sucking model, manual type, w/vacuum gauge.	C					
23	Hydrometer (bouyoucos)	12 units	For student practice of testing soil physics. ASTM D422	C					
24	UPS, 2KVA	2 units	Attached to sophisticated (micro-computer built-in) equipment. 2KVA	A	○				
25	Roofing materials and equipment for green house	1 lot	Roofing material: plastic, S model, w/irrigation pipes, pots, shading net	A		○		○	SS
26	UV spectrophotometer	1 unit	For the course of 'Soil Chemistry' and 'Soil Survey' for photometric analysis. Special designed for soil analysis						
Department of Agricultural Engineering									
< Postharvest >									
1	Chroma meter	1 unit	To conduct color tests on vegetables and fruits. 8mm probe, xenon lamp, color resolving: ±0.0002	A	○				
2	Vacuum oven	1 unit	To conduct tests for postharvest processing of vegetables and fruits. Laboratory use, Working temp.: 40°C~200°C, 25L	A		○		○	SS
3	Grain separator, laboratory model	1 unit	To conduct tests of cleaning of cereal. laboratory use, 2 stage of cleaning : sieve and aspiration	A		○			
4	Pelletizer	1 unit	For study on processing of animal feed. Laboratory use	A					
< Electrical Engineering >									
5	Cathode ray oscilloscope	1 unit	For experiment of the course of 'Principle of Electricity'. 100MHZ, stage type, 2ch	A		○			
6	Digital multimeter, desktop	1 unit	For test of voltage, current, resistance and circuit. Desk top digital DC/AC 0~100V, current 0~10A, resistance: 0~∞	E		○			
7	Frequency counter	1 unit	For experiment of the course of 'Principles of Electricity'. Frequency 0.1HZ~100MHZ	A		○			
8	Signal generator (Function generation)	1 unit	For experiment of the course of 'Principles of Electricity'. 0.1HZ~100MHZ	A		○			
9	DC and AC motor test bench	1 unit	For the course of 'Instrumentation'. Bench model. DC/AC motor, generator, transducer for student practice	A	○				
< Workshop >									
10	Metal working lathe	1 unit	For metal workshop. Working table width: 200 mm	D		○		○	
11	Milling machine	1 unit	For metal workshop. Working table width: 36"	D		○		○	Manufacture
12	Wood working lathe	1 unit	For wood workshop. Distance from center: 1500 mm	D		○		○	and

No.	Equipment	Quantity	Purpose and specification	Criteria	Newly placed	Replaced	Supplemented	Joint use	Department
13	Tenon cutting machine	1 unit	For wood workshop. 4 axes, tenoning length: 80mm, working dimension: 400 x 125 x 1200mm	D	○			○	Repair work
14	Metal shear	1 unit	For metal workshop. Manual type, applicable 4 ft width and 1/8" thickness	D	○			○	
15	Metal roller	1 unit	For metal workshop. Manual type, diameter of roll: 100 mm, thickness: 2.4 mm, applicable: 4ft	D	○			○	
16	Metal bender	1 unit	For metal workshop. Manual type, thickness: 2.0mm, applicable: 6 ft	D	○			○	
17	Wood shaping machine	1 unit	For wood workshop. Working table width: 1 ft, horizontal and vertical shifting table	D	○			○	
18	Welding plant (MIG/TIG) w/stainless steel, aluminum reels	1 unit	For metal workshop. MIG: > 135A with CO ₂ gas cylinder, TIG: > 300A argon gas cylinder, one set of stainless / aluminum wirecable	D	○			○	
	< Agricultural Experiment Station, Meewahira >								
19	Tractor, 4 wheel with implements	1 set	For student practice / farming management. 35~40HP, W/trailer and disk plow and etc.	A		○			
20	Tractor, 2 wheel with implements	1 set	For student practice / farming management. 10~12HP rotary tiller	A		○			
21	Sprinkler experiment unit, w/engine drive water pump	1 lot	For student practice. W/hydrostatic tester, sprinkler heads and engine pump.	A	○				
Department of Agricultural Extension									
	<AUDIO VISUAL UNIT>		for courses : Agric. Basic Communication, Journalism, Social Science Research Methods, Public Relations. Learning of video camera & still camera operation, editing practices for video & radio program. Service activity for Faculty and other Department such as Photo shooting, video duplicating, preparation of presentation materials	C				○	All Departments
1	Color Video Camera	2 units	Standard format, w/standard lens & view finder, Business use type			○			
2	Video Camera Long Distance Zoom Lens	1 unit	10~140 mm, Zoom x 16			○			
3	Vido Camera View Finder	1 unit	Color, 5 inch		○				
4	Field Monitor	2 units	Color, 7-9 inch, w/shade food		○				
5	Tripod for Video Camera	2 units				○			
6	Lighting Kit	2 sets	Indoor/outdoor use, 240V/1000W, 3 lights & 3 tripods, w/Day light balancing filter			○			
7	Portable Electric Generator	1 unit	for lighting & battery charging, Diesel, 5 KVA, w/extension cable		○				
8	Portable Digital Audio Tape Recorder	2 units	w/carrying case, microphone			○			
9	Equipment Transport Vehicle	1 unit	4WD Station wagon, Diesel, w/roof carrier & equipment rack		○				
10	Videocassette Player	1 unit	for video editing, A/B Roll System			○			
11	Videocassette Recorder/Player	2 units	for video editing, A/B Roll System			○			
12	Editing Monitor	3 units	Color, 14 inch			○			
13	Editing Control Unit	1 unit	A/B Roll System			○			
14	Multi Effect Switcher	1 unit			○				
15	Editing System Console / Rack	1 set				○			
16	Digital Audio Tape Player	1 unit				○			
17	Digital Audio Tape Player/Recorder	1 unit				○			
18	Digital Audio Tape Editing Control Unit	1 unit				○			
19	Spool Tape Player/Recorder	1 unit	Open reel, 4 trucks			○			
20	Power Amplifier	1 unit				○			
21	8-channel Audio Mixer	1 unit				○			
22	CD Player	1 unit					○		
23	Stereo cassette tape player/recorder	1 unit				○			
24	Video Tape Duplicator	1 set	1 to 2 duplication		○				
25	Cassette Tape Duplicator	1 set	1 to 2 duplication			○			
26	35 mm Camera	1 set	Manual focusing type, w/lens (20mm, 300mm)				○		
27	Medium Format Still Camera	1 set	for large enlargement purpose (ex. poster), 6 x 4.5, w/lens (50mm, 80mm, 200mm)			○			
28	Cassette Tape Recorder/player for Slide Projector Synchronize	1 unit				○			
29	Slide Projector	1 unit	Halogen bulb, for small room			○			
	<D.T.P. / INFORMATION LAB.>		for practices such as preparation of bulletins, leaflets, poster. transform video/photo data into printing material by through PC. Service activity for Faculty and other Department such as preparation of presentation materials	E				○	All Departments
30	Personal Computer	1 unit	IBM compatible, 17 inch color monitor, attached memory device, 133 MHZ, 2 GB HD, 32 MB RAM		○				
31	Color Scanner	1 unit	A4 size		○				
32	Color Bubble Jet Printer	1 unit	A3 size		○				
33	Film Scanner	1 unit	35mm film/Slide film to PC data		○				
34	Film Recorder	1 unit	PC data to Slide film		○				

No.	Equipment	Quantity	Purpose and specification	Criteria	Newly placed	Replaced	Supplemented	Joint use	Department
35	Digital Printer	1 unit	Three color		○			○	Dept. of Agricultural Economics
Department of Agricultural Economics									
1	Personal Computer	4 units	for data analysis & processing, report writing, PC communication, IBM compatible (100 MHz, 800MB HD, 8MB RAM & 166MHz, 1.2 GB, 32MB RAM)	E			○		
2	Laser Printer	1 unit	A3 size, Mono color (black/white)	E			○		
3	UPS	1 unit	for PC, 1.5 KVA	E			○		
4	Air Conditioner	1 unit	for PC Room, Wall hanging type	E			○		
5	Stencil Duplicator	1 unit		E		○			
6	Stencil Cutter	1 unit		E		○			
7	Photocopier	1 unit	A4/A3 size, w/Paper feeder	E		○			
Common Facility & Equipment									
	<PRINTING UNIT>		for printing Faculty and Department Publications					○	All departments
1	Offset Press	1 unit	Max. printing size : A3 (one side), Mono color	E		○			
2	Film Processor	1 unit	for halftone printing	E	○				
3	Automatic Electrostatic Platemaker	1 unit	Max. image size : A3	E		○			
4	Electric Paper Cutter	1 unit	Max. paper size : 25 inch	E		○			
5	Paper Holder	1 unit	Single fold, A3 to A4	E	○				
6	Paper Jogger	1 unit	A4 size	E	○				
7	Thermal Book Binder	1 unit		E		○			
	<FACULTY COMPUTER UNIT>		for computer classes :beginner level & intermediate level for report writing.					○	All departments
8	Personal Computer	25 units	IBM compatible, 100 MHz, 800MB HD, 8MD RAM	E			○		
9	Laser Printer	2 units	A3 size, Mono color (black/white)	E			○		
10	UPS	4 units	2 KVA	E			○		
11	Air Conditioner	2 units	10 KW, Floor type	E			○		
	<COMMON LECTURE ROOMS>								
12	Public Address System & Video Presentation	3 sets	29-32 inch TV, Video Player, Microphone, Speaker	E	○				
13	OHP	3 units	A4 size stage, Halogen lamp, Zoom	E		○			
14	Slide Projector & Screen	3 sets	Halogen, Zoom 75 - 125 mm, 150 inch screen w/tripod	E		○			
	<FACULTY AUDITORIUM>							○	All departments
15	Public Address System	1 set	Speakers, Microphones, Amplifier, CD player, Cassette tape player	E	○				
16	Video Projection System	1 set	LCD Video projector, 150 inch screen (wall hanged spring roller type)	E	○				
17	OHP	1 unit	A4 size stage, Halogen lamp, Zoom	E	○				
18	Slide Projector	1 unit	Halogen, Zoom 150 - 250 mm	E	○				
	<OTHER>								
19	Personal Computer for Library	2 units	for book management & book search service, IBM compatible (100 MHz, 800MB HD, 8MB RAM & 166MHz, 1.2 GB, 32MB RAM)	E			○	○	All departments
20	Mini Bus	1 unit	for student transportation (farm practices, study trip) 25 seats, Diesel, w/air conditioner	E			○	○	All departments

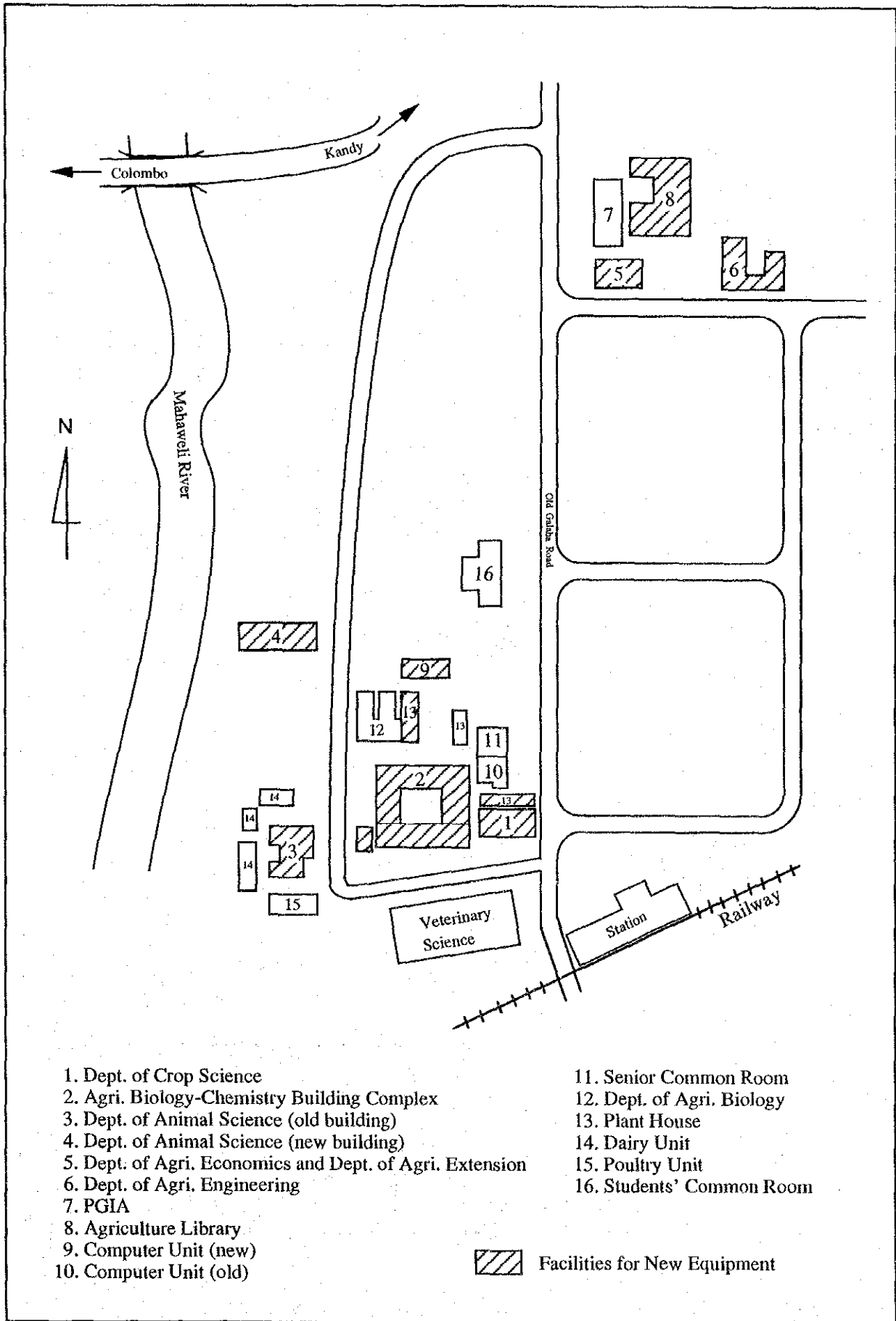
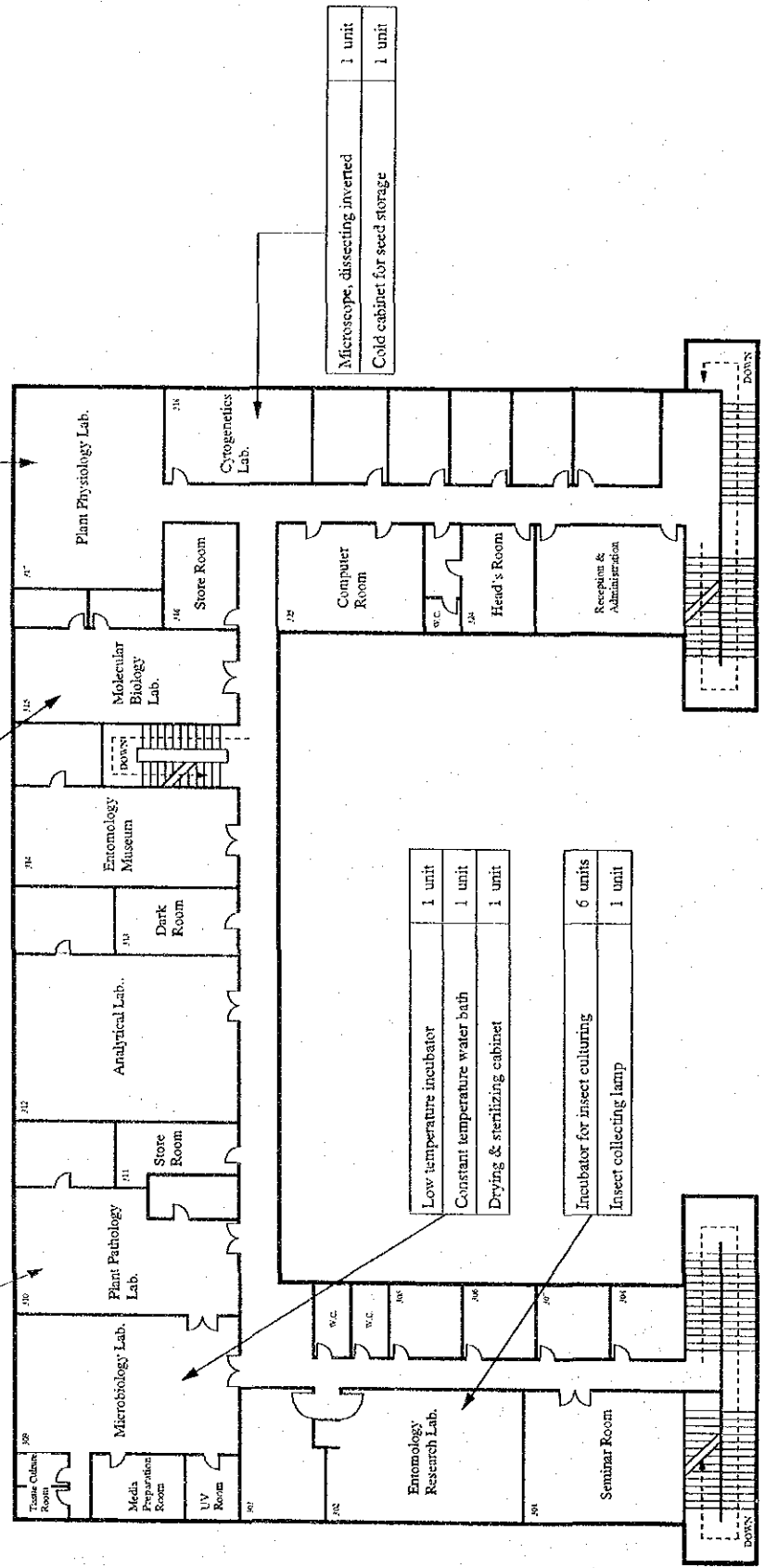


Fig. 2-2 Layout of the facilities - Faculty of Agriculture

Laminar flow unit	1 unit
Auto Clave	1 unit
Fume cupboard	2 units
Microscope, phase-contrasting, research	1 unit
Photosynthesis meter, portable	1 unit
Quantum / Radiometer / Photometer	1 unit
Food analyzer	1 unit

PCR reactor	1 unit
Bio-image system	1 unit
Centrifuge, refrigerated	1 unit
Electroporator with cuvette	1 unit
Deep freezer	1 unit
UV spectrophotometer	1 unit

Microplate reader	1 unit
Laminar flow unit	1 unit
Auto Clave	1 unit



Microscope, dissecting inverted	1 unit
Cold cabinet for seed storage	1 unit

Low temperature incubator	1 unit
Constant temperature water bath	1 unit
Drying & sterilizing cabinet	1 unit

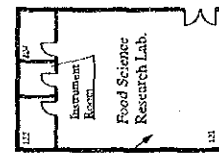
Incubator for insect culturing	6 units
Insect collecting lamp	1 unit

Fig.2-3 Layout of equipment (1/10 Dept. of Agricultural Biology)

Agri. Biology-Chemistry Building Complex 1F

Hunter calory meter	1 unit
Kjeldahl unit, micro	2 units
Microscope, biological, student	5 units
Centrifuge	5 units
Fume cupboard	2 units
Euytometer centrifuge	2 units

Fluorophotometer	1 unit
UV spectrophotometer, double beam	1 unit
Apparatus for crude fiber	1 unit
Atomic absorption spectrophotometer	1 unit
HPLC	1 unit
UPS, 2KVA	2 units
Fraction collector	1 unit
Water distillation unit	1 unit
Refrigerator	1 unit
Centrifuge, refrigerated	1 unit



Dehydrator, Laboratory model, with turner (fruits/vegetables)	1 unit
Water distillation unit	1 unit
Refrigerator	1 unit

Bomb calorimeter	1 unit
Amino acid analyzer	1 unit
Gas chromatograph	1 unit
Refrigerator	1 unit

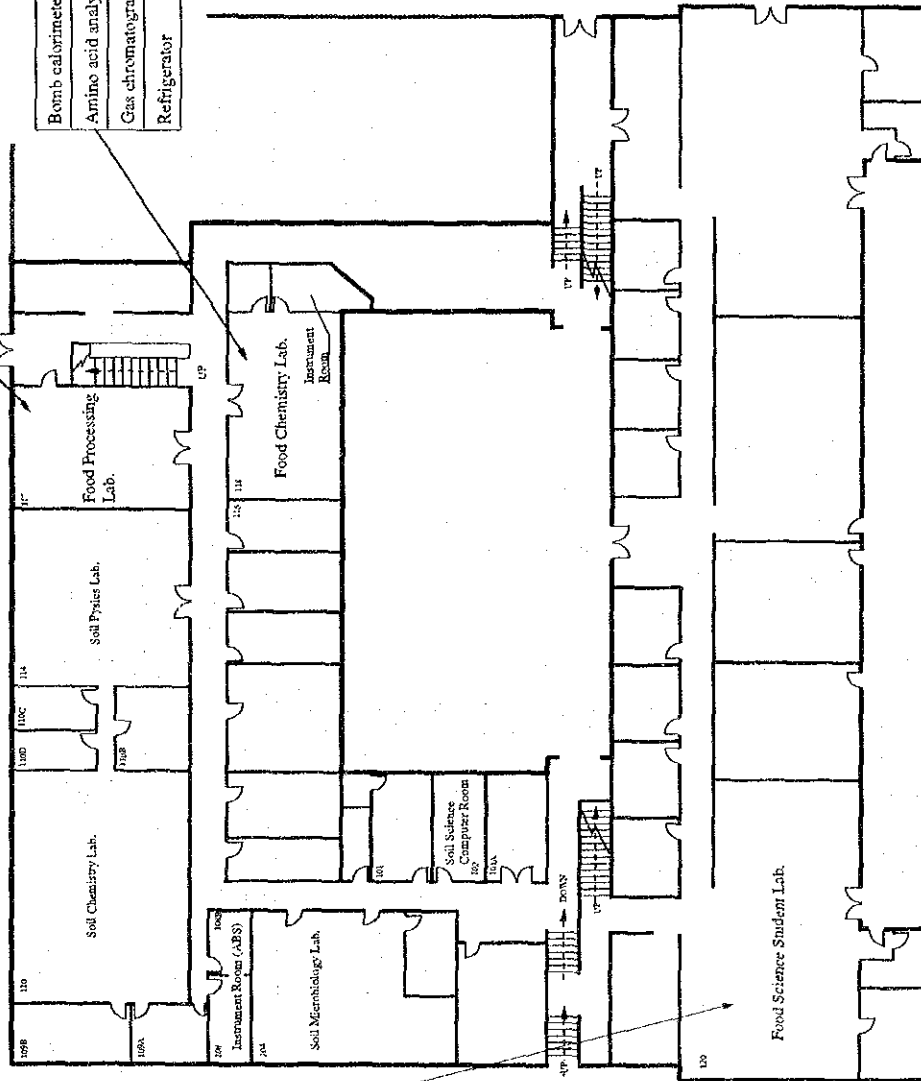


Fig. 2-3 Layout of equipment (2/10 Dept. of Food Sciences & Technology)

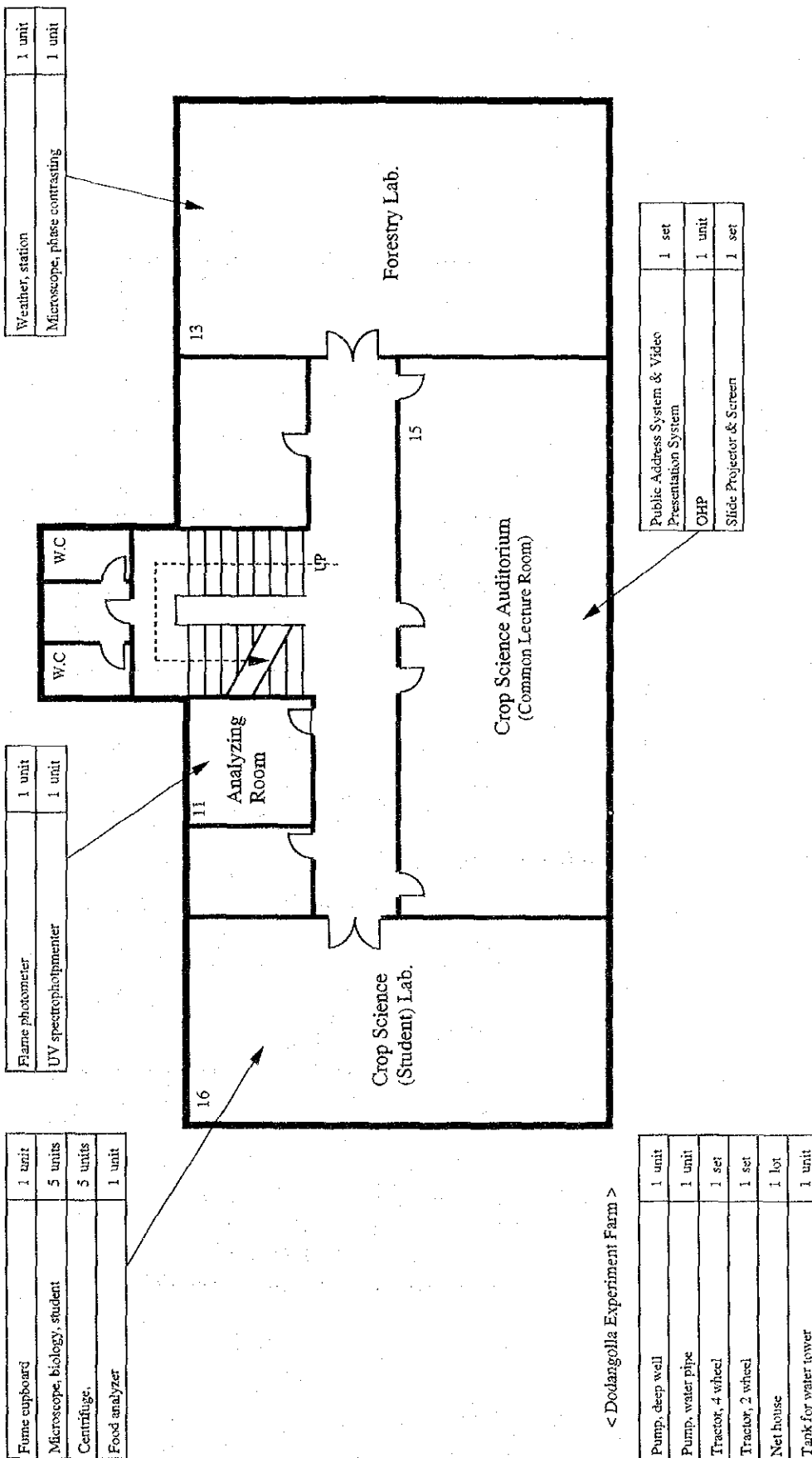
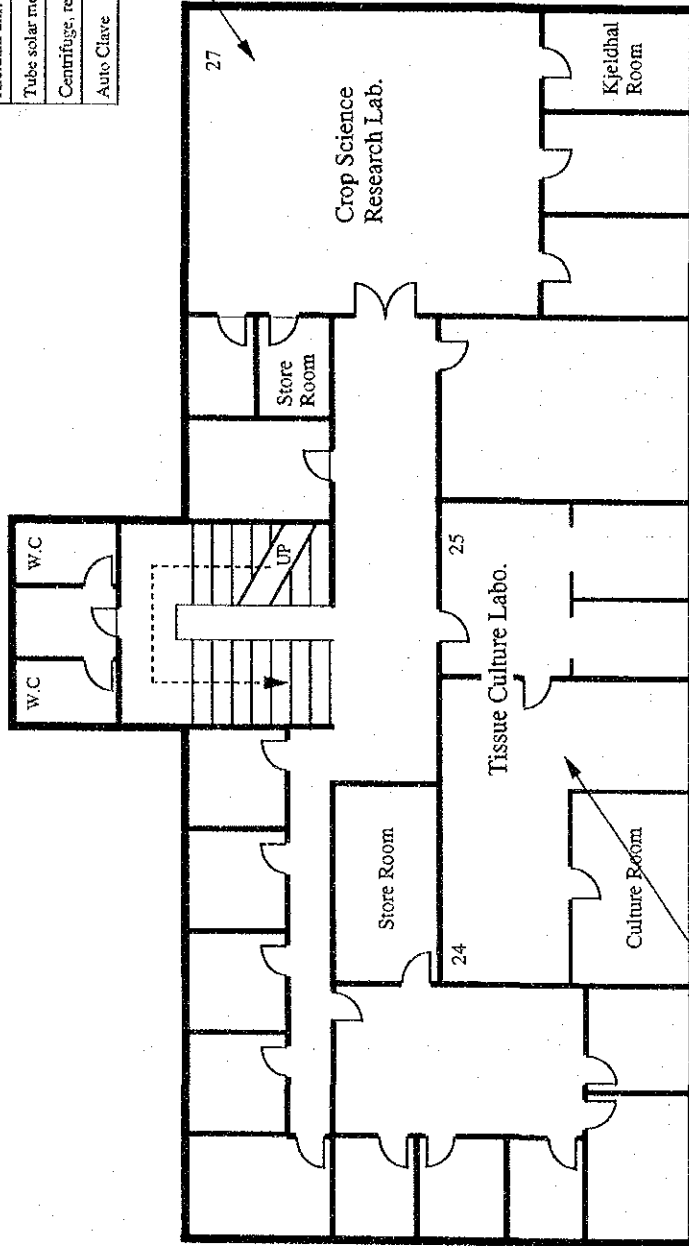


Fig. 2-3 Layout of equipment (4/10 Dept. of Crop Science)

Porometer	1 unit
Fume cupboard	1 unit
Leaf area meter	1 unit
Kjeldahl unit	2 units
Tube solar meter	2 units
Centrifuge, refrigerated	1 unit
Auto Clave	1 unit



Laminar flow unit	1 unit
Microscope, dissecting, research	1 unit
Auto Clave	1 unit

Fig. 2-3 Layout of equipment (5/10 Dept. of Crop Science)

Dept. of Animal Science (New Building 1F)

Water quality meter	1 unit
Circular rearing tank	10 units
Dryer	1 unit

Public Address System & Video Presentation System	1 set
OHP	1 unit
Slide Projector & Screen	1 set

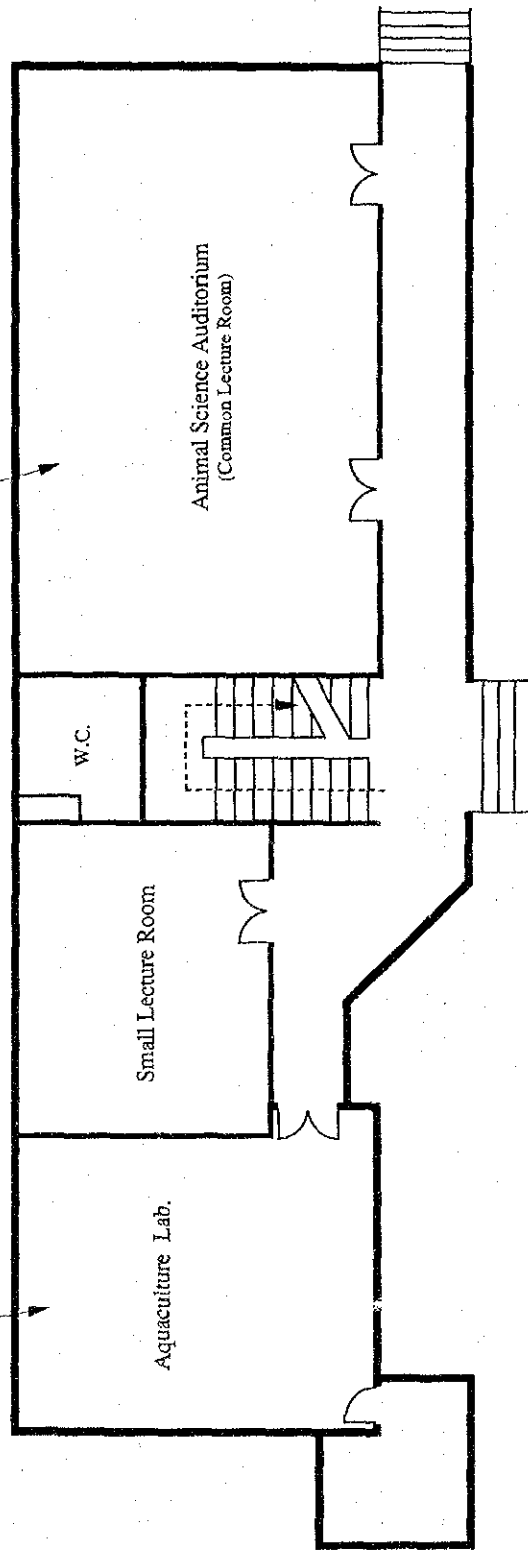


Fig. 2-3 Layout of equipment (6/10 Dept. of Animal Science)

Dept. of Animal Science (New Building 3F)

Microscope, phase contrasting	1 unit
Differential blood cell counter	1 unit
Centrifuge, refrigerated	1 unit
Ion meter with electrode	1 unit

Fume Cupboard	1 unit
Microscope, Biological, for student	3 units

Bomb calorimeter	1 unit
UV spectrophotometer	1 unit
Automatic Kjeldahl apparatus	1 unit
Fiber extraction apparatus	1 unit
Flame photometer	1 unit
HPLC	1 unit
Fume Cupboard	1 unit
Centrifuge, refrigerated	1 unit
Atomic absorption spectrophotometer	1 unit
Water distillation unit	1 unit
Dryer	1 unit

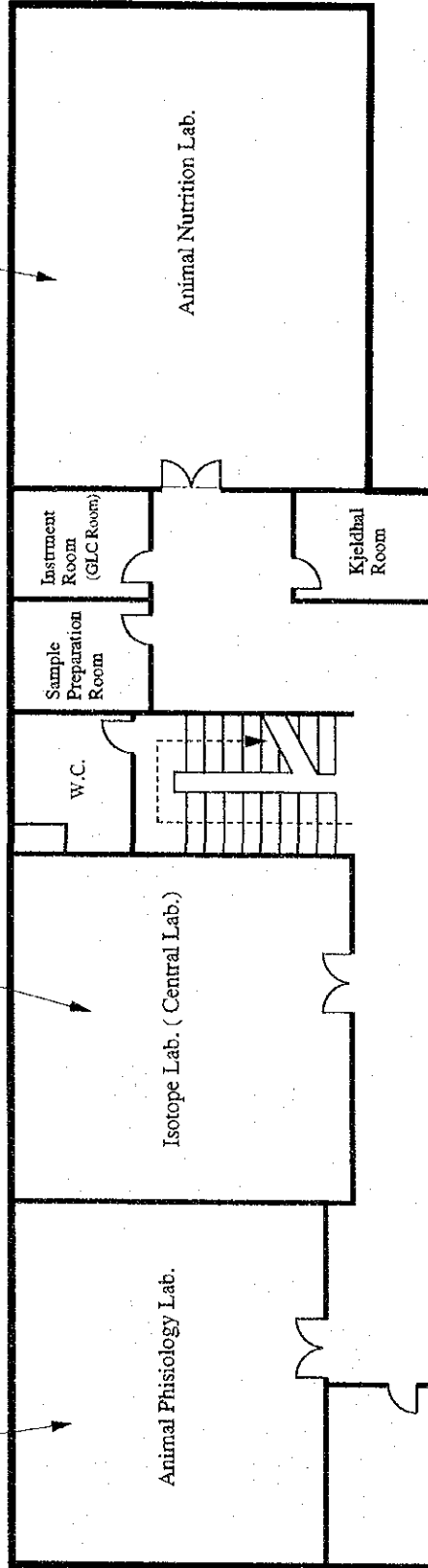


Fig. 2-3 Layout of equipment (7/10 Dept. of Animal Science)

Metal working lathe	1 unit
Milling machine	1 unit
Wood working lathe	1 unit
Tenon cutting machine	1 unit
Metal shear	1 unit
Metal roller	1 unit
Metal bender	1 unit
Wood shaping machine	1 unit
Welding plant (MIG/TIG) w/stainless steel, aluminum reels	1 unit

Chroma meter	1 unit
Vacuum oven	1 unit
Grain separator, laboratory model	1 unit
Pelletizer	1 unit

< Meewatura Experiment Farm >

Tractor, 4 wheel with implements	1 set
Tractor, 2 wheel with implements	1 set
Sprinkler experiment unit, w/engine drive water pump	1 lot

Cathode ray oscilloscope	1 unit
Digital multimeter, desktop	1 unit
Frequency counter	1 unit
Signal generator (Function generation)	1 unit
DC and AC motor test bench	1 unit

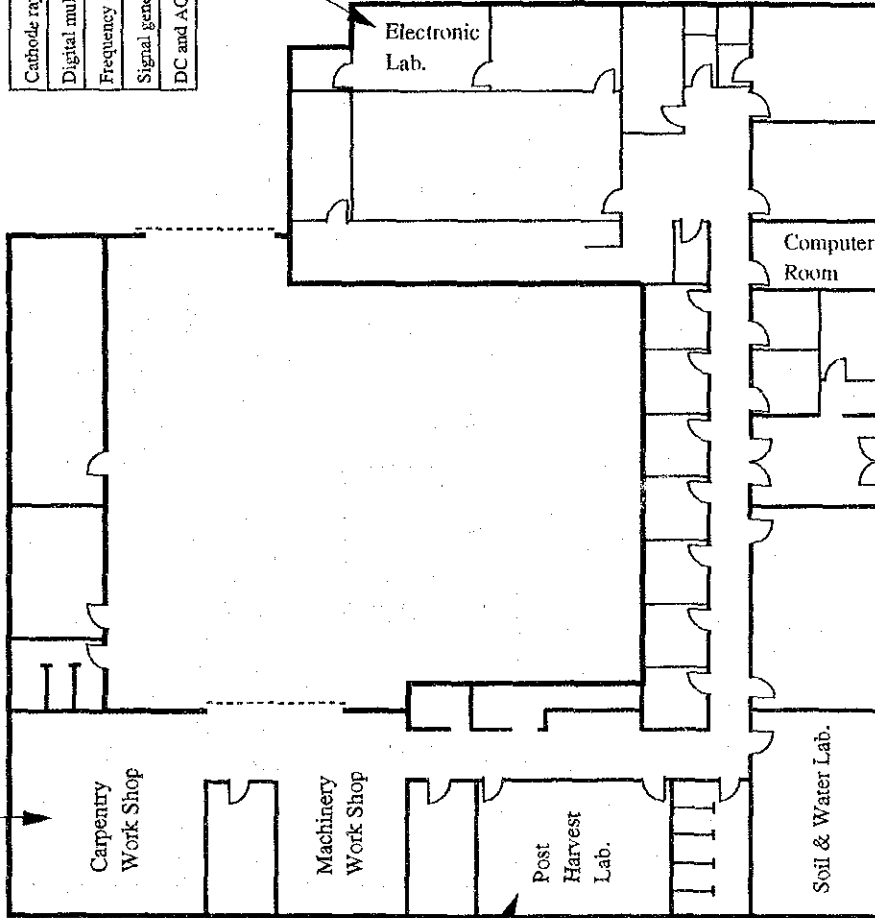


Fig. 2-3 Layout of equipment (8/10 Dept. of Agricultural Engineering)

Economics & Extension Building 1F

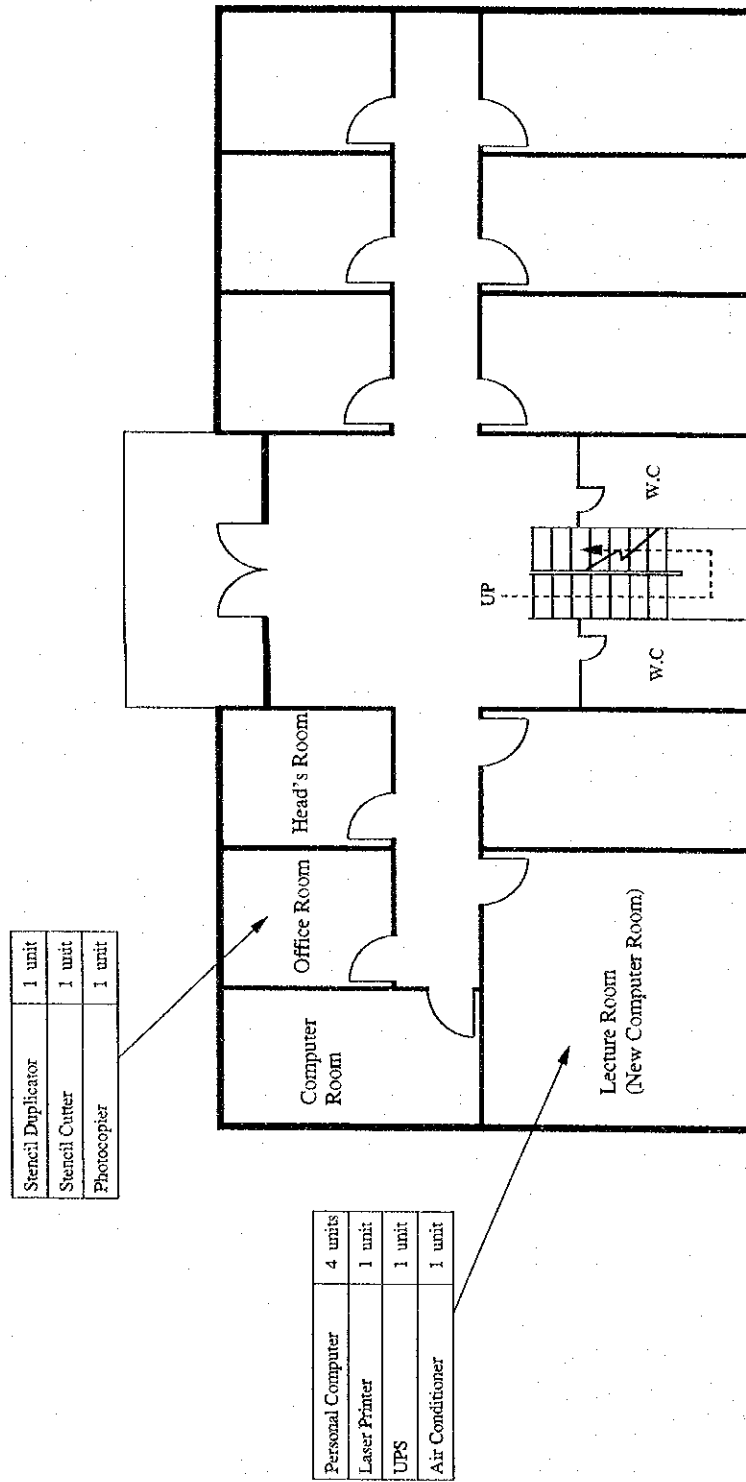
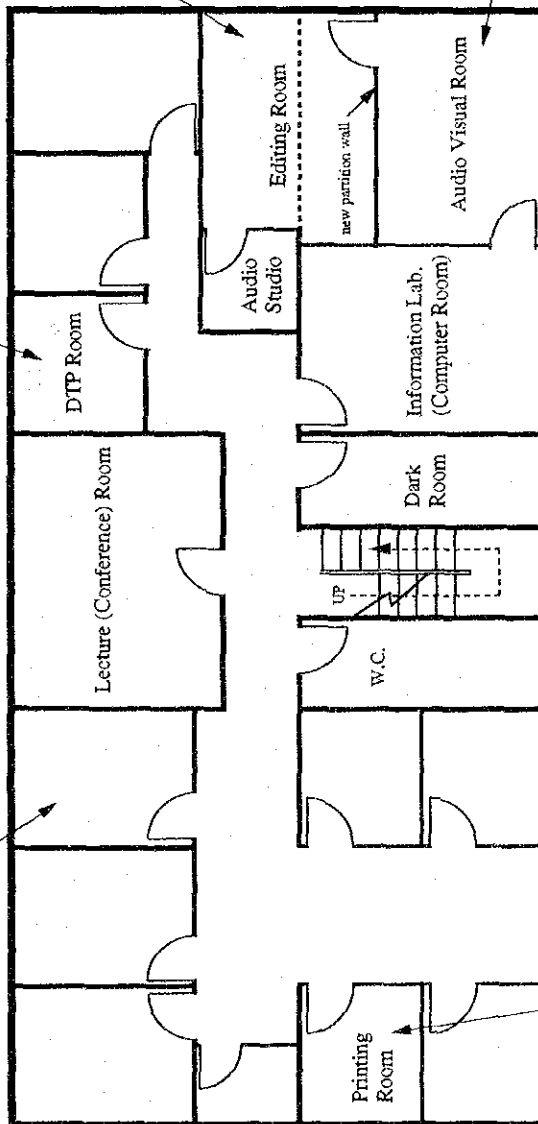


Fig. 2-3 Layout of equipment (9/10 Dept. of Agricultural Economics)

Economics & Extension Building 2F

Personal Computer	1 unit
Color Scanner	1 unit
Color Bubble Jet Printer	1 unit
Film Scanner	1 unit
Film Recorder	1 unit

Slide Projector	1 unit
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Digital Printer	1 unit
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Videocassette Player	1 unit
Videocassette Recorder/Player	2 units
Editing Monitor	3 units
Editing Control Unit	1 unit
Multi Effect Switcher	1 unit
Editing System Console / Rack	1 set
Digital Audio Tape Player	1 unit
Digital Audio Tape Player/Recorder	1 unit
Digital Audio Tape Editing Control Unit	1 unit
Spool Tape Player/Recorder	1 unit
Power Amplifier	1 unit
8-channel Audio Mixer	1 unit
CD Player	1 unit
Stereo cassette tape player/recorder	1 unit
Video Tape Duplicator	1 set
Cassette Tape Duplicator	1 set

Color Video Camera	2 units
Video Camera Long Distance Zoom Lens	1 unit
Video Camera View Finder	1 unit
Field Monitor	2 units
Tripod for Video Camera	2 units
Lighting Kit	2 sets
Portable Electric Generator	1 unit
Portable Digital Audio Tape Recorder	2 units
35 mm Camera	1 set
Medium Format Still Camera	1 set
Cassette Tape Recorder/player for Slide Projector Synchronize	1 unit

Fig. 2-3 Layout of equipment (10/10 Dept. of Agricultural Extension)

