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

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

MARCH 1998

JAPAN INTERNATIONAL COOPERATION AGENCY
UNICO INTERNATIONAL CORPORATION

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PREFACE

In response to a request from the government of 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 Equipment for the Faculty of Engineering, University of Peradeniya and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Sri Lanka a study team from January 7 to 28, 1998.

The team held discussion 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 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.

March 1998

Kimio Fujita

President

Japan International Cooperation Agency

March 1998

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 Engineering, University of Peradeniya in the Democratic Socialist Republic of Sri Lanka.

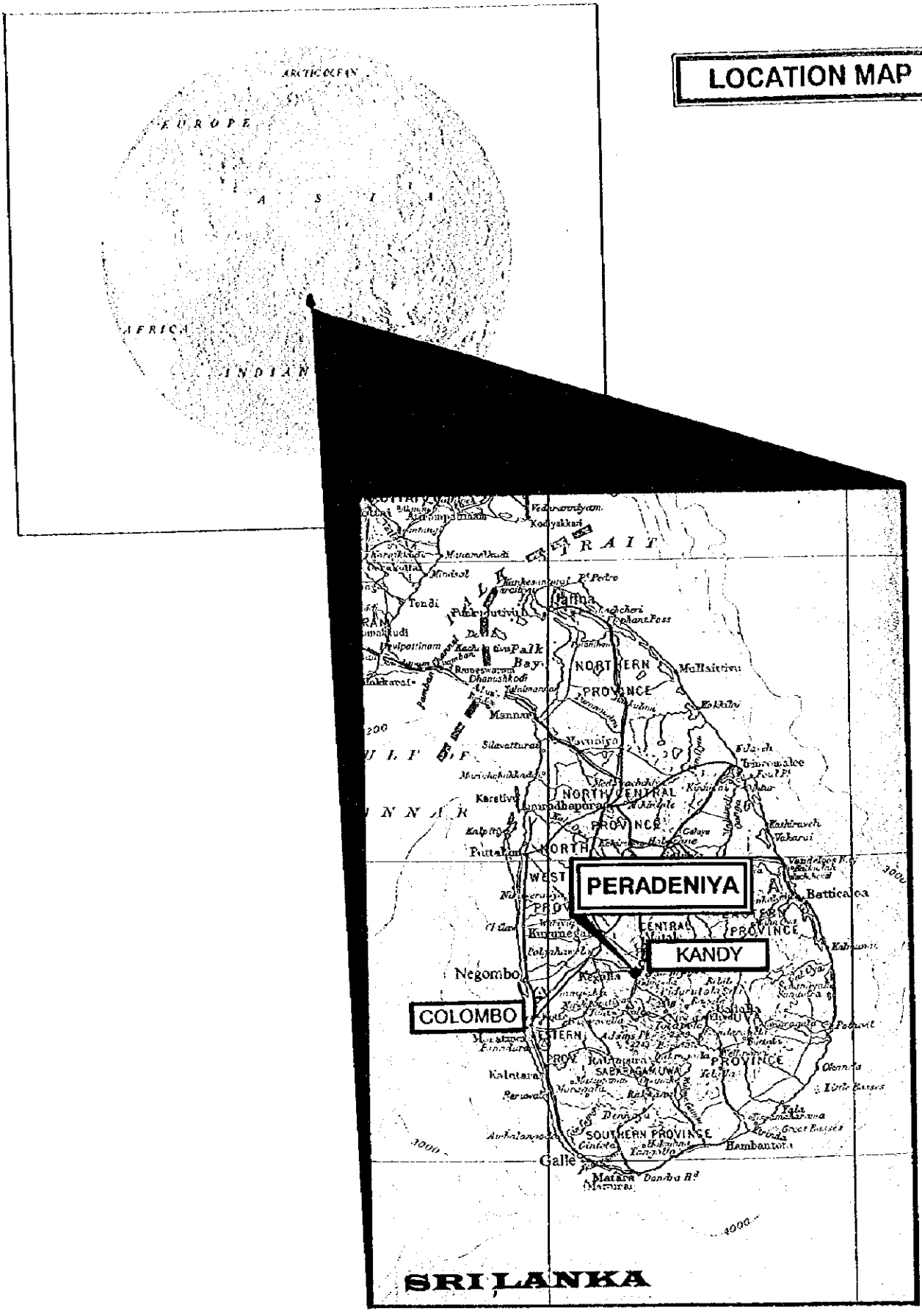
This study was conducted by UNICO International Corporation, under a contract to JICA, during the period from December 25, 1997 to March 27, 1998. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Sri Lanka and formulated the most appropriate basic design for the Project under Japan's grant aid scheme.

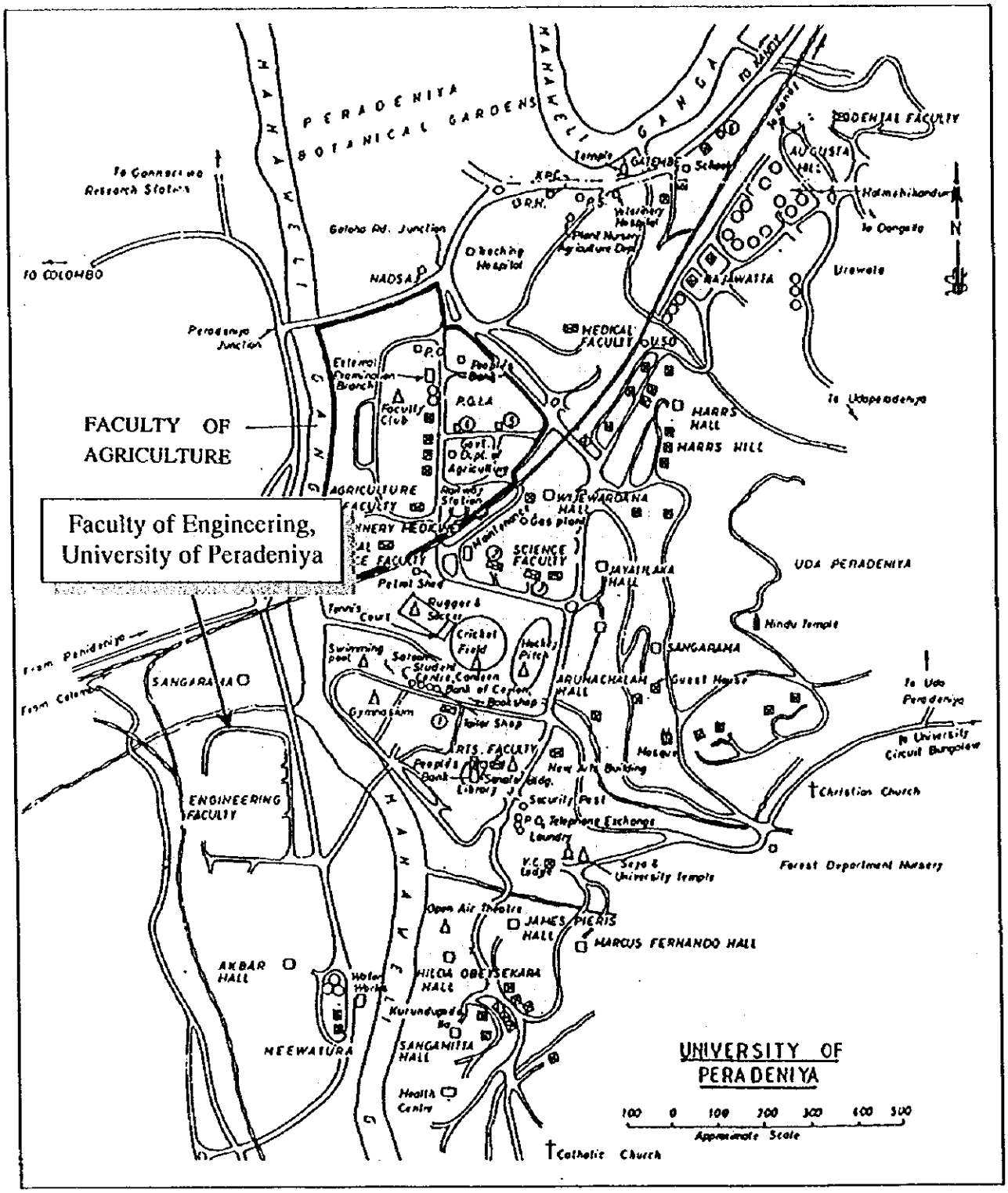
Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,

Hirofumi Yamauchi
Project Manager
Basic design study team on
the Project for the Improvement of
Educational Equipment for the Faculty of
Engineering, University of Peradeniya
UNICO International Corporation

LOCATION MAP





SKETCH MAP OF UNIVERSITY OF PERADENIYA

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CHAPTER 1 BACKGROUND OF THE PROJECT

Chapter 1 Background of the Project

1- 1 Historical Background

The economy of Sri Lanka has been heavily dependent upon export of primary products such as tea leaves and natural rubber, resulting in sharp decline of GDP and other consequences due to climatic changes and fluctuation of international prices. Upon reflection of the situations, the government of Sri Lanka pursued reform of the economic structure dependent on export of agricultural products and implemented " export-oriented industrial development," "promotion of investment by foreign investors" and "privatization of governmental public corporations" under guidance of IBRD and IMF. Based on these policies, the government worked out in 1989 a 5 year public investment plan (1989-1993) and actively implemented measures to promote export of industrial products. Further, the government announced in August 1994 a declaration on new industrialization policies. Based on the declaration, a long term development plan was prepared to actively improve economic environment, relax regulations and provide economic/financial incentives for the purpose of industrialization within 10 years from 1996 to 2005 under the leadership of the government. The purposes of the industrialization policies are "diversification and improvement of industrial foundations," "effective utilization of human resources," " nationwide expansion of employment and income," "strengthened exports" and " regional industrialization." All these purposes are intended to secure employment by revitalization of industries and to strengthen financial backgrounds increased exports. On the other hand, the government announced a higher education policy to bring up senior engineers to lead industrialization of the country, reconfirming the necessity to develop human resources for industrialization. By the target year 2001, the government intends to increase its budget for higher education from about 0.4% in 1996 to 0.6% at least. Promotion of higher education including training of senior engineers is expected to contribute to establishment of modern industrial technologies in Sri Lanka and stable growth of the economy.

The share of senior engineers, technicians and assistant engineers among all workers is increasing gradually from 1994 but the supply of such human resources is not enough. Although the industries highly require senior engineers, the education institutions for such engineers (engineering universities) in Sri Lanka do not have the sufficient quality of software and hardware. In the Faculty of Engineering, the

University of Peradeniya, the representative institution in higher engineering education, the equipment for education are becoming too obsolete and old to impede the higher engineering education. The government of Sri Lanka therefore requested the government of Japan to offer a grant aid for improvement of equipment of the Faculty.

1-2 Outline of the Request

In 1983, the Japanese government extended a grant aid for improving education and experiment equipment of the Faculty of Engineering, the University of Peradeniya. As 15 years have passed since that time, the equipment are becoming obsolete and old, resulting in serious deterioration of education environment. Therefore, the government of Sri Lanka requested improvement of appliances for education and experiment including mainly the renewal of existing equipment. The list of required equipment were prepared 2 years ago and the intention of the request is the same as at that time. However, manufacture of some equipment was discontinued and the university partially changed its curriculum. Therefore, the basic design study team received a revised list reflecting partial changes in the original list.

The request includes equipment suggested by the departments of civil engineering, production engineering, mechanical engineering, electrical and electronic engineering, chemical engineering, engineering mathematics, computer sciences; the language laboratory, the computer center and the lecture hall for the Faculty of Engineering (the equipment belong to the dean's office).

To confirm particulars of the request the study team (" the team" hereinafter), the team had an in-depth discussion with the Faculty of Engineering, according to the basic policy of the team. In other words, the team confirmed the curriculums for each set of materials or equipment as well as the methods of experiments and exercises. Further, the team eliminated as much as possible the following equipment: duplicated requests, those which are problematic in terms of maintenance and management costs, those with functions which do not fit the education levels of undergraduates, those which are not required urgently, those which can be procured by the university's own efforts, etc. For plural sets of equipment requested, the team adjusted the amount of the grant aid by minimizing the number upon confirmation of experiment/exercise

methods. As to the specifications of equipment, the team recommended that any unnecessary functions be eliminated in consideration of the purposes of education and ensured that the equipment would be sustainable in terms of maintenance and management of them. In addition, the team investigated into the broader plans of Sri Lanka, industries' requests to the Faculty of Engineering and the employers' of former students and worked out a list of requested equipment which meet the demands of the time. As to the equipment additionally requested during the study in Sri Lanka, the team evaluated their necessity, urgency and appropriateness based on the said basic policies. The entire items were included in the minutes as a final list of requested equipment.

Table 1-1 shows outline of the requested equipment.

Table 1-1 Main Equipment Requested by Each Department

Department	Outline of Request	Main Equipment
Civil Engineering	Testing and Experimental Equipment for Metallurgy, Materials, Fluid Mechanics, Survey 、 Soil Mechanics, Structures Laboratories	NDT Equipment, Universal Testing Machine, Total Station, Dutch Cone Penetrometer, Structural Loading System, etc.
Mechanical Engineering	Testing and Experimental Equipment for Applied Mechanics, Applied Thermal Mechanics, Materials Science, Fluid Mechanics Laboratories	Thermal Conductivity Measuring Apparatus, Forced Convection Heat Transfer Apparatus, Refrigeration/ Air Conditioning Training Equipment, Industrial Microscope, etc.
Production Engineering	Testing and Experimental Equipment for Control, Instrumentation, Machining Techniques Laboratories	Conveyor Loop with Magnetic Reader/Writer for CIM Training, CNC Machining Center, Surface Roughness Measuring Machine, Motion Control Hardware, Hydraulic System, etc.
Engineering Mathematics	Equipment for Engineering Mathematics Models Training	Computer Image Projection System, etc.
Computer Science	Training Equipment for Logic Analysis, Computer Process Experiments	Logic Analyzer, etc.
Electric and Electronics Engineering	Testing and Experimental Equipment for Basic Electric, Communication, Control, Electrical Circuit Laboratories	Waveform Monitor, Network Analyzer, Digital Communication Teaching Kit, Antenna Demonstration Kit, Protective Relays, DC Voltage Current Standard Set, etc.
Chemical Engineering	Testing and Experimental Equipment for Applied Thermal Mechanics, Fluid Mechanics, Biochemistry Process, Operation Logic Laboratories	High Temperature Muffle Furnace, Continuous Flow Centrifuge, Pressure Homogenizer, Atomic Absorption Spectrophotometer, etc.
Language Laboratory	Equipment for Language Training	Open Reel Master, Tape Recorders, etc.
Computer Centre	Equipment for Computer Training to all the Faculty Students	Uniterrupted Power Supply, Line Printer, Plotter, PC Server, etc.
Dean's Office	Equipment for Auditorium and Field Studying	Color Video Projector, Multimedia Projector, Power Amplifier, etc.

CHAPTER 2 CONTENTS OF THE PROJECT

Chapter 2. Contents of the Project

2-1. Objective of the Project

The demand in Sri Lanka for senior engineers are continuously growing due to the government's policy for industrialization and the needs of the labor market and industries.

As higher engineering education institutions, there are only 2 faculties of engineering in the University of Moratuwa and the University of Peradeniya.

The Faculty of Engineering, the University of Peradeniya, is educating excellent students from all areas of the country including the Colombo area. The university is successfully ensuring harmony between races (Simhala and Tamil) and has relatively higher ratio of female students. Thus, the university can ensure valuable employment opportunities regardless of race and sex. Therefore, it is found that the improvement of education equipment at the Faculty of Engineering, the University of Peradeniya, is likely to have favorable influences throughout Sri Lanka.

Further, instructors of each department told us of the employers of former students as indicated below. The team understood the people graduating from the Faculty will have much influence on the industries and the government agencies.

Department Graduates/year	Promotion /year	Major employers			
Civil engineering 140	14~15	Government agencies : 50~60	Private firms: construction, building, dams, resources development consultant : 60~70		
Mechanical engineering 40	5~6	Assistant engineer at universities: 15~20	Civil servants: 5	Private firms:5	
Production engineering 30	5	Civil servants:5	Private firms(SINGAR, Comp.Parts,Textile,etc.) :20		
Chemical engineering 40	4~5	Civil servants (public oil co., etc.):10	Other private firms (agricultural products processing, machinery, communications, etc.) : 25		

Electricity/electronics 60	5~10	CEB(public power co.):5~8	SLT (public power c):5	Private communication machinery co.:15~20	Software houses:10
Computer sciences 20	5	Software houses:10~15			

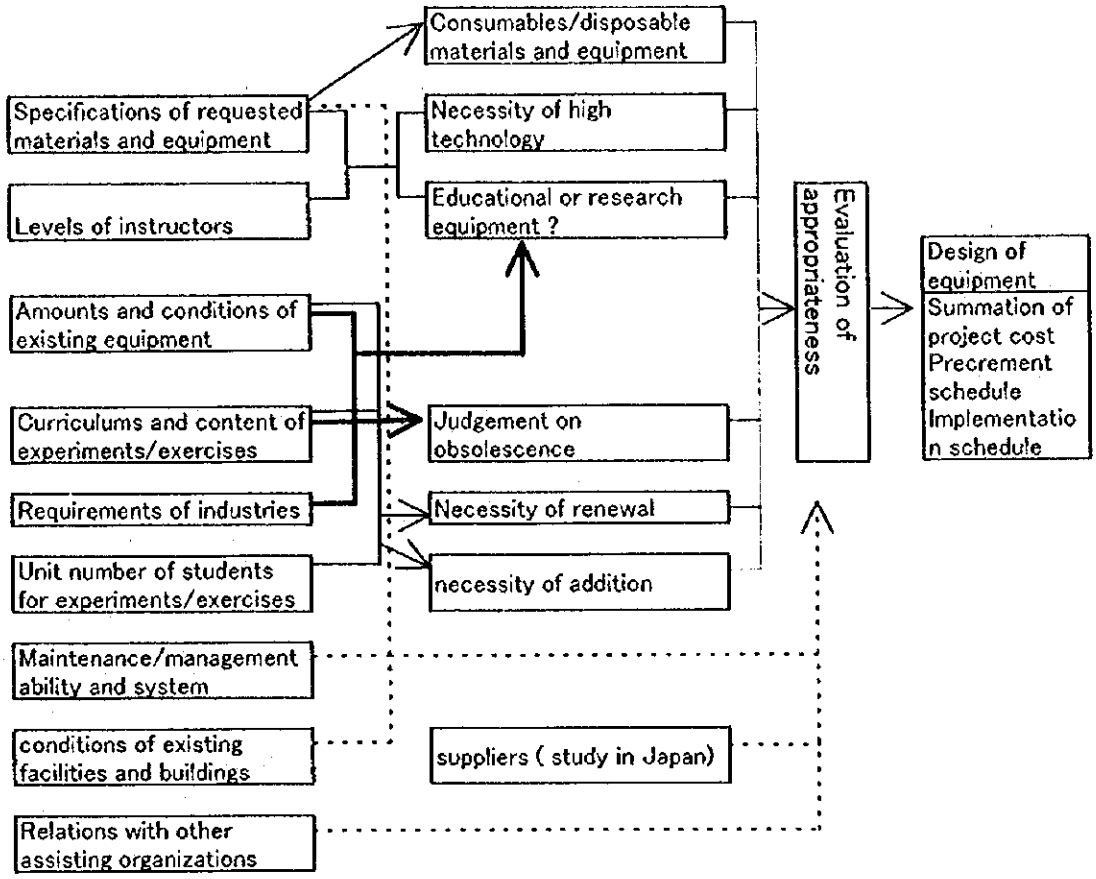
In 1983, the Japanese government extended a grant aid for improving education and experiment equipment of the Faculty of Engineering. As 15 years have passed since that time, the equipment are becoming obsolete and old, resulting in serious deterioration of education environment. The current plan aims to bring up human resources contributing to the development of industries in Sri Lanka by improving education and experiment equipment, mainly through renewals of the existing equipment. As the industrialization policies and higher education policies of Sri Lanka aim to develop practical human resources to make future leaders of the country, the project is in conformity with these broader policies.

2-2. Basic Concept of the Project

(1) Overall Concept

The Project aims to achieve the following targets: to meet the educational needs of industries in Sri Lanka by renewing the obsolete and old equipment in the Faculty of Engineering, the University of Peradeniya; improvement of the educational environment and learning effects at the university; and to stably supply high quality engineers over long term (the basic concept of designing equipment is shown in the following flowchart).

Flow Chart of Designing Matrials and Equipment



Therefore, the team conducted investigation into and confirmation on the following matters to examine the request.

1) Equipment with problems in terms of maintenance and management costs
2) Equipment with functions which do not fit the educational levels for undergraduate students
3) Equipment which are not so urgently needed and can be procured by the university with its own provisions
4) Equipment which can be maintained and managed with the present system
5) The requested equipment which can be ensured effective, long term utilization of them with the present maintenance system/ability

Based on the results of study in Sri Lanka as mentioned above, the team employed the following basic concept in designing equipment.

Prioritized equipment:

1) which are indispensable for education of undergraduate students and cannot be improved by the University with its own efforts;
2) which are presently utilized but need urgent addition due to increased number of students;
3) which are remarkably obsolete or old and need urgent renewal; and
4) which need to be urgently provided due to progress of education such as revised curriculums.

Excluded equipment:

1) which need high technology and cost remarkably high in maintenance and management;
2) which require large scale renovation or construction of buildings for installation;
3) for which spare parts cannot be procured easily in Sri Lanka;
4) which are too much advanced and does not fit the needs of the country's industries;
5) which are specialized for particular groups or education/research subjects of students and instructors;
6) necessity and appropriateness of which cannot be confirmed with the curriculums;
7) which are consumable or disposable;
8) which are solely manufactured by specific makers or sold through specific channels; and
9) which are planned to be provided by other assisting organizations.

Other considerations

1) For plural sets of equipment requested, the team is to set the amount at the minimum required number upon focus on conformity among experiment/exercise methods, focusing on unit number of students in individual experiments/exercises and amount of existing equipment.
2) Supplies and consumable should be excluded as much as possible from the equipment to be improved, upon comparison with the prices of equipment and examination of urgency.
3) Personal computers will be mainly installed at the computer center to initiate favorable effects to the entire Faculty of Engineering and to eliminate unequal among departments, with consideration as well that personal computers cannot be used over a long term because of fast alternation of their generations.
4) Renewals of existing equipment shall be prioritized.

5) Additional equipment to make up for the insufficient amount of existing equipment shall be prioritized.
6) The equipment in conformity with the curriculums or their changes shall be prioritized.
7) The team is to mainly focus on the educational equipment for the undergraduate and students.
8) The equipment should match the ability of the university in operation and maintenance/management.

Based on the entire terms as mentioned above, the concept of the project was developed as mentioned below, as a result of confirmation in on-site study and examination of contents in Japan in regard to the equipment requested by Sri Lanka.

(2) Examination of the Request

1) Scope of the Request

The Faculty of Engineering has four divisions under the dean, namely the computer center, the workshop, the industrial education division and the industrial development division supervised by respective directors. Also, it has seven departments, namely the civil engineering department, the electric/electronic engineering department, the mechanical engineering department, the engineering mathematics department, the chemical engineering department, the production engineering department and the computer sciences department supervised by respective heads.

The request for equipment pertaining to this study are to be used by the seven departments mentioned above, the dean's office (which controls the equipment to be used for seminars and lectures at the large hall and the medium hall), the computer center and the language laboratory, i.e. 10 organs in total.

There are 320 undergraduate students in each academic year. Because the University was closed due to domestic turmoil from 1987 to 1990, it admitted entitled students (so called "backlogs") afterwards. It has therefore 1,500 students now. In most cases, two or three students make a unit in the Faculty of Engineering so that they can directly operate equipment and perform experiments and exercises. The

team, therefore, determined the amount of equipment considering the amounts of existing equipment as well as the units of experiments and exercises, so that as many students as possible may directly operate the equipment. The content and scale of the planned equipment are shown in the table below.

2) Current status of education courses

Students in the first and second years have to take education courses by instructors of each department including lectures on the basics of engineering as well as exercises and experiments.

A unit of two or three students in each year spends six hours a week for experiments and exercises (for some experiments or exercises, the unit may be comprised of 4 to 5 or 5 to 6 students due to limitation in the number of equipment as well as the number of instructors).

Students will belong to either of the specialized courses (departments) from the third academic year. This assignment is based on the achievements in the first and second years and the capacity of each department.

Students in the third and fourth grade will learn expertise of each department by lectures, exercises and experiments. At this stage, third year students may select a subject to search a theme by exercises at firms and research into the theme in the fourth year spending about three hours a week over one year to prepare a report for presentation. This is what they call a "project". The project will be a compulsory subject after revision of the curriculums scheduled in 1999/2000.

3) Civil Engineering Department

The Civil Engineering Department is the largest department in the Faculty of Engineering and the students in the department account for about 60% of the entire Faculty. There are 280 students in the third and fourth year specialized courses. There are 37 instructors. The Civil Engineering Department is classified into the following three majors.

Materials and structural engineering:

Geological engineering and transportation engineering (including soil mechanics, geology and road engineering); and

Water resources and environmental engineering (including fluid dynamics, waterway/river engineering, hydraulics and environmental engineering)

In the last year, students can select basic engineering, computerized structural analysis, water resources engineering, etc. The equipment are requested by each laboratory. Materials laboratory, metallurgy laboratory, fluid dynamics and environmental laboratory, survey laboratory, soil mechanics laboratory, etc. require basic equipment for exercises, including a few with advanced analyzing functions, such as universal testing machine, cohesionmeter, scanning electron microscope, two dimensional wave generator, automatic data logger, echo sounder, various surveying instruments, standard penetration testing set, moisture equilibrium testing set, soil column sample compression testing system, etc.

Although the equipment as a whole were short and old, they had maintained basic functions for education to a certain extent. In the discussion on the requested equipment, the team determined that scanning electron microscope, echo sounder, vibration table, etc. should be excluded because they are expensive and not urgently needed, considering the urgency for education purposes. Similarly, the team determined the degree of priority concerning the scanner, the potable concrete core cutter for the materials laboratory. As to the CAD laboratory, the team decided that no aid would be given assuming utilization of the computer center as stated in the basic policies.

4) Chemical Engineering Department

The chemical engineering department was established in 1981 with chemistry and process engineering majors. As supplementary courses, there are fluid molecule dynamics, thermodynamics, instrumentation and control and biochemical control. The department has four laboratories, namely basic chemistry laboratory, instrumentation/control laboratory, chemical reaction laboratory and reaction/extraction laboratory. As of January 1998, the department had five instructors in total and 45 students in the third and fourth years. The requested equipment are composed of basic experimental systems such as various analyzing

systems (carbon/hydrogen/nitrogen analyzer, water quality analyzer, organic carbon analyzer, nitrogen oxides analyzer), oven, sterilizer, mixer, etc. The team excluded CHN (carbon/hydrogen/nitrogen) coder and total carbon analyzer because the existing equipment are in a good condition and can be effectively used and there are not many students to use them.

5) Mechanical Engineering Department

Students in the first year must study drawing and thermodynamics in the mechanical engineering department. Throughout the Faculty, 320 students in total take the subjects. The second year students must study applied thermodynamics and structural engineering. More specifically, exercising subjects include measurement of properties of steam using steam plant and measurement of heat of gases, analysis of exhaust gases from engines, cooling/heat exchange systems, vibration and hydraulic/jack mechanism.

The third and fourth year students take specialized courses. There are 100 students in the third year, of which 40 study production, 40 mechanical and 20 chemical. There are 60 students in the fourth year, composed of 40 in mechanical and 20 in chemical. Major exercising subjects in the specialized courses include freezing, cooling, fluid heat exchange, internal combustion engine, beam vibration, journal bearing, whirling of shafts, servo system and its mechanism, and water turbine.

The mechanical engineering department has major laboratories for applied mechanical engineering and heat/engines as well as a drawing room. The applied mechanical engineering laboratory has various sets of equipment for experiments and exercises, most of which were designed and manufactured by themselves for education purposes. The major experiment items are vibration, control, lubrication, etc. The heat/engine laboratory performs heat conduction, combustion and engine tests as well as basic experiments or advanced research related to agricultural engineering. To support such experiments, the Faculty requested such basic equipment as thermal conductivity measuring apparatus, hydraulic system tester, thermocouple, atomic absorption photometer and flowmeter. The team excluded rotor balancing equipment, gas turbine test bed, etc. because they would not be widely used, the number of students are limited and the costs were relatively high.

6) Production Engineering Department

The production engineering department has three majors, namely manufacture engineering, production management, and industrial engineering and industrial automation. Students will select either manufacturing technology or production management. There are 80 students in the third and fourth years which will be divided into production engineering and mechanical engineering majors. The department requested equipment mainly for the exercises in production engineering of the fourth year students. They spend six hours a week for exercises divided into two sessions. The 40 students are divided into two groups and five students make a unit in experiments. There are six instructors now.

The requested equipment included continuous magnetic code reading/writing system, industrial robot, workstation and CNC machining center which are expensive. The team determined that they are highly appropriate and urgent, considering the conformity with the curriculums, required specifications and the number of students. On the other hand, the team excluded industrial robot, laser interferometer, NC punch, glass fiber borescope, etc. because they were neither urgently required nor appropriate, considering frequency of use, curriculums, etc.

7) Electric/electronic Engineering Department

The electric/electronic engineering department has a basic electricity/electronics course for all students in the Faculty of Engineering. Students in the department have to study three courses including electric power, communications and electronic control or computer engineering and further select and study one major area in either electrical engineering or electronic engineering.

There are 22 instructor positions in the electric/electronic engineering department but seven instructors are covering the whole area. 60 students are admitted to the department but 120 students wish to be admitted. It is because of the shortage in the number of instructors and equipment that all applicants cannot be admitted. Major employers of graduates include power company (public), Sri Lanka Telecom (public), communications system company such as Cellular and computer companies.

The request of electric/electronic department include some new equipment which are in the curriculums but have been only explained in the lectures. In light of the basic policies, the team determined that the request included mainly the equipment with high education effects, urgency and appropriateness excluding those which can be adequately provided by the university with its own efforts and some not urgently needed

8) Computer Sciences Department

The computer sciences department is a new department established in 1985. It has "programming" and "application software" courses for all students in the Faculty of Engineering and "computer sciences and logic circuits" course for students of the electric/electronic engineering department. There are two instructors, 40 students in the third year and 20 in the fourth year, i.e. 60 students in total. Computers were indispensable equipment for the curriculums and included in the original request. The Faculty agreed that it will fully utilize the computer center according to the basic policy that introduction of computers should be minimized. It was found that the other equipment are appropriate for education purposes.

9) Engineering Mathematics

All students (640) in the Faculty of Engineering must study engineering mathematics courses (mainly computer languages: PASCAL, FORTRAN, algebra, C language, etc.) in the first and second years. All the courses require some knowledge in computers and individual training is available for students with less ability. To graduate, a student must earn a credit in statistics (seminar), mathematical analysis or graduation thesis. There are 10 instructors in total.

Only for third year and forth year students majoring in industrial mathematics, lectures and exercises will be given in numerical control, mathematical analysis, statistics, etc. The requested equipment included overhead projector, computer image projection system and regulated DC power supply, which the team considered appropriate because of the conformity with the present curriculums and the number of students.

The team determined that audio recording and replaying system was not in

urgent need because the engineering mathematics department can improve it with its own efforts.

10) Language Laboratory

Among the staff belonging to the university's English education division, 16 instructors are in charge of English education in the Faculty of Engineering. Students in the 13th grade (forth grade in high school) will take examinations in August for qualification for universities and they enter universities in January next year. (Because there are backlogs due to four years' closure of universities from 1986, students have to wait some two years from qualification to entrance. The Faculty of Engineering has five batches of students instead of the normal four batches.) English education for the Faculty of Engineering starts six months before entrance into the university. This is what they call "postal course." Students' abilities will be evaluated by a placement test and they study by themselves for six months using the materials corresponding to the evaluation. Students will join an intensive course upon entrance into the university. Intensive course will be held consecutively for 10-12 weeks, Monday through Thursday, 8:30 a.m. to 3:30 p.m. One class has about 30 students but students with less English proficiency are grouped into a class of 15-18. About 30% of the freshmen have very weak English proficiency1) . Intensive course will be held before academic courses, i.e. departments' courses of the Faculty of Engineering. Therefore, the period of the intensive course is sometimes as short as 7 weeks. After the start of the academic courses, students study English 4 hours a week in the "on-going course" which is compulsory from the first year through the forth year. 320 students in each year are divided into 12 groups. As mentioned earlier, the Faculty of Engineering has five batches of students and the language laboratory teaches 1,600 students (320 x 5) as far as the on-going course is concerned. For the period of intensive course, four additional instructors will be assigned.

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1) National University Education Policy (June 1996): national Education commission considers that certain mastery of English is necessary for engineering education. It is noted that the University of Peradeniya has nationwide coverage of students including many of those lower income, underdeveloped areas where language education is insufficient. Much emphasis is placed on English education with an expectation for favorable effects.

11) The Computer Center

The computer center is open to all students in the Faculty of Engineering. Short computer courses for beginners from 5:00 p.m. to 7:00 p.m. are available for administrative staff. During daytime, computers are operating 100% for classes of each department, exercises of third and forth year students and researches. The center has 40 units of Pentium PCs and 36 units of 386 PCs. Computers are highly important in the engineering education and the requirements on the computer center are very high due to limited numbers of computers in each department. At present, computers are used for 185 thousand hours per year for classes only, which means the 78 units are fully operating 200 days a year if used for 12 hours a day. Therefore, the center has been totally declining the departments' request for using computers for new curriculums. The center intends to extend the open hours until 10:00 p.m. to meet students' requests but this is not the final solution to the absolute shortage of computers. The team found that computers should be intensively installed at the center, considering the situations of sharing resources among departments and faculties and the levels of operation/maintenance.

2.3 Basic Design

2-3-1. Designing Policy

(1) Basic Policy

The team designed the levels and specifications of the planned equipment pursuant to the following policy.

1) The equipment should be within the scope of university education.
2) They must not be available for any research or experiment by particular persons.
3) They require no extensive modification of facilities and equipment in installation.
4) Operation, maintenance and management costs should be minimized.
5) Easy maintenance and management (maintenance-free situation is an ideal)
6) Specifications which do not limit the supply to one manufacturer.
7) The equipment should not lead to contamination of nearby environment.
8) Their working life should be long and they can be effectively used over long term.
9) Easy procurement of spare parts and materials for repairing

10) The equipment should comply with the local laws and standards.

(2) Policy Regarding Procurement of Equipment

According to the points confirmed with the Sri Lanka side based on the basic policy of the basic design study, the team considered the following points in planning equipment.

1) The university will purchase consumable and supplies with its annual operation budget and these are not included in the plan of the equipment.

2) For maintenance and repair of scientific equipment in Sri Lanka, engineers from Singapore come often due to the geographical location and the flight situations. Therefore, the team decided that manufacturers having representatives in Sri Lanka as well as those with representatives in Singapore should be prioritized.

2-3-2 Basic Design

(1) Basic Design

Based on the design policy discussed in the previous section, the consultant set basic design criteria as follows.

1) Adequate performance levels for university engineering education
2) Equipment which conforms to local laws, regulations and standards
3) Equipment for which after-sales support by a local agent is available
4) Equipment which does not require sophisticated techniques and skills for operation and maintenance
5) Equipment of which their working life should be long and they can be effectively used over long term in due consideration of maintenance and operational capability of the Faculty
6) Equipment which are not limited to specific manufacturer
7) Equipment which require minimum amount of operational and maintenance cost
8) Equipment which does not cause environmental pollution or which is provided with adequate pollution control

In addition to the above mentioned design criteria, the following considerations were given on the basis of the project site condition and agreement with the Faculty.

1) Consumable and spare-parts for the new equipment provided under the Project should be fully prepared by the Faculty
2) Because of the availability of after sales support and the accessibility to procure spare parts, equipment which has local agent in both Sri Lanka and or in Singapore will give higher priority when procure

(2) Project Site

1) Project site

The project site is located at south-west side of Kandy, second biggest city in the country. There is Mahawelli river which is the biggest river in the country at the south of the campus. The Faculty has twenty four buildings including administration buildings such as offices, library, processing training and engineering training unit, each teaching rooms and laboratories, workshop, student center, computer center auditorium. The facilities has a floor area of about 23,900 square meters. Each facility and laboratory has wide and independent areas and abundant for conducting experiments and educational practices. The Faculty is scheduled to do away with some part of obsolete and aged equipment when the Project come to the last stage, therefore, enough space for new equipment would be assured. It has past about 35 years since the University of Peradeniya as well as the Faculty moved from Colombo city in 1964. during the period, the Faculty has been renovating building facilities to provide good educational conditions. In this connection, necessary utilities such as electrical wiring, gas, water are installed at each laboratories and buildings now. In addition, there is enough space to store new equipment temporarily during the installation period of the Project. Equipment maintenance and security appear to be sufficient to keep equipment safely and good in condition because of the system employed in the Faculty is strict. Thus, the Faculty buildings and facilities are acceptable as the project site.

2) General layout of the campus

Figure 2-1 shows the general layout of the campus.

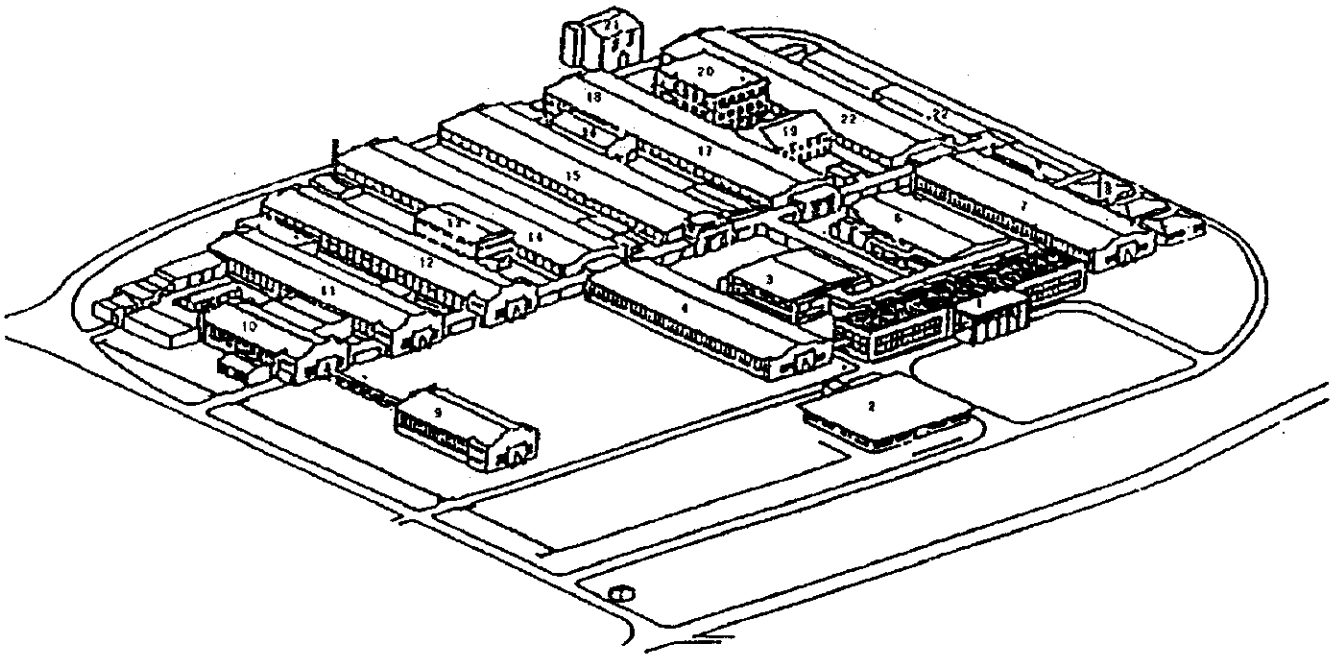
(3) Equipment Plan

Outline of the major equipment is shown in Table 2-1.

(4) Layout Plan of Equipment

Layout Plan is shown in Figure 2-2.

FACULTY OF ENGINEERING
UNIVERSITY OF PERADENIYA
SRI LANKA



ENGINEERING COMPLEX : FACILITIES

1. Administration Building (Offices, Library, Eng. Mathematics, Industrial Training & Audio-Visual Studio)
2. Twin Lecture Theatres
3. E.O.E. Pereira Theatre
4. Drawing Office I & Language Laboratory
5. Students' Centre
6. Canteen
7. Car Park
8. Electrical & Electronics Laboratories
9. High Voltage Laboratory
10. Computing Centre
11. Electronics Workshop
12. Surveying Laboratory
13. Soil Mechanics Laboratory
14. Chemical Engineering Laboratory
15. Materials, Metallurgy & CAD Laboratories
16. Fluid Mechanics & Environmental Laboratories
17. Applied Mechanics Laboratory
18. Thermodynamics Laboratory
19. Engineering Workshop I
20. Engineering Workshop II
21. Motor Vehicle Repair Unit
22. Production Engineering Laboratory
23. New Library & Lecture Halls (under construction)
24. Structures Laboratory Drawing Office III & Lecture Theatre
25. Drawing Office Ii & Lecture Halls

Figure 2-1 General Layout of Campus

Table 2-1 Outline of Major Equipment

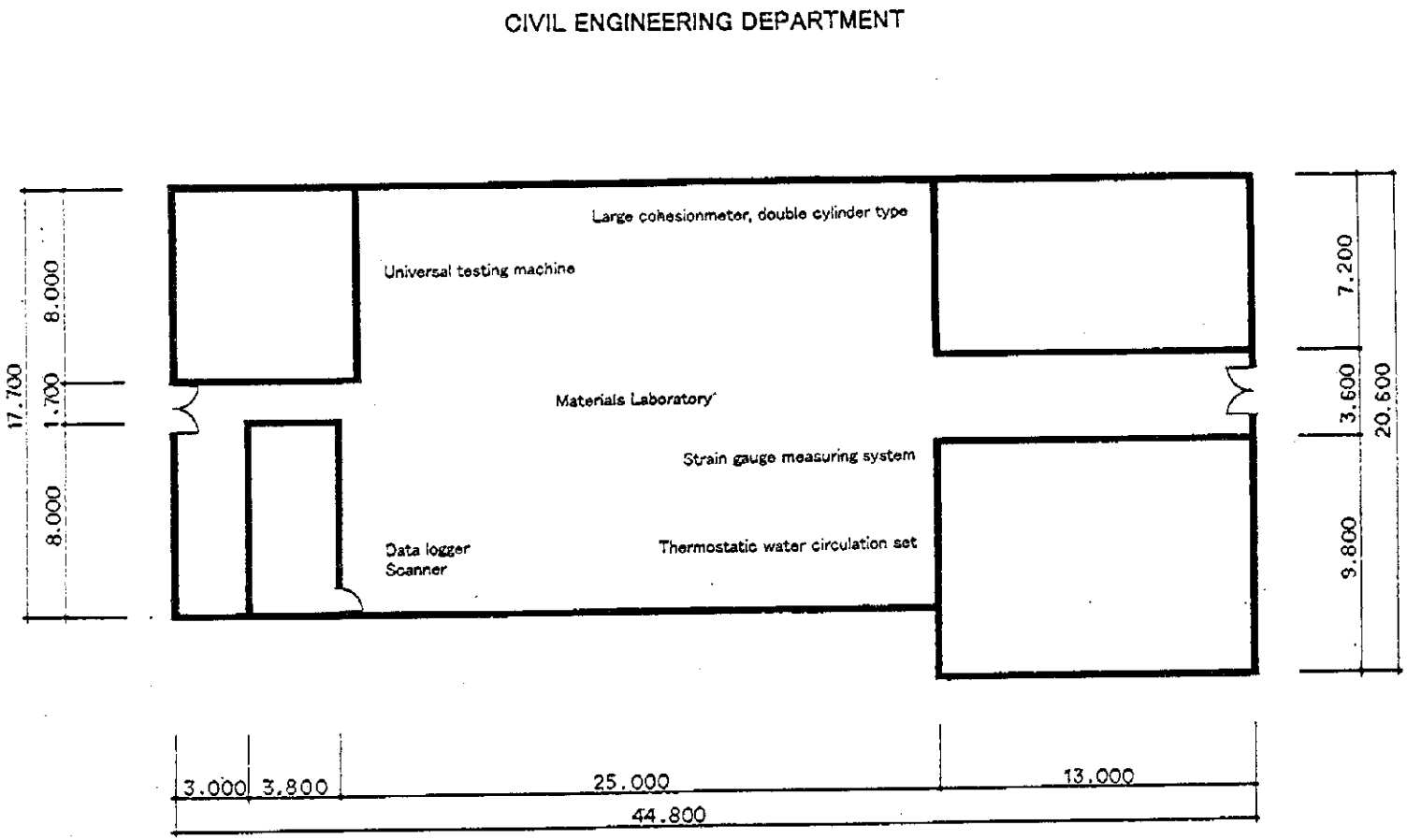
Item	Description	Specifications	Q'ty	Reason for selection
1. DEAN'S OFFICE				
	Color Video Projector System	Luminous flux 800lumen or more, Pixel 1.6million or more	1	Obsoleteness due to remodeling since years
	Multimedia Projector, portable	For 600 seat auditorium; for projection of computer output	1	Obsoleteness due to remodeling since years
	Power Amplifier	For 600 seat auditorium; Output ca. 800W	1	Obsoleteness due to remodeling since years
2. CIVIL ENGINEERING				
	Metallurgy Laboratory			
	Non-destructive testing apparatus	X-ray tube output ca. 160-300kV	1	Newly required by revision of curriculum
	Micro hardness tester	Load ca. 2kgf, Microscope reading min. 0.1 micrometer	1	Deterioration by equipment life expiration
	Vickers hardness tester	Load ca. 20 to 50kgf, Microscope min. 0.1 to 0.25 micrometer	1	Deterioration by equipment life expiration
	High Temperature Furnace	1500-1600°C	1	Deterioration by equipment life expiration
	Metallurgical Microscope with camera arrangements	Magnification 50x-1000x stage180x140, camera 35mm, 30VA	1	Addition to the existing equipment which is short in quantity
	Universal Testing Machine	With recycling load system. Max load ca. 100ton, tension ca. 1000 mm, compression ca. 900mm, bending ca. 800mm。	1	Addition to the existing equipment which is short in quantity due to increase of students
	Large cohesionmeter, double cylinder type	Inner cylinder rotating type. Inner cylinder 120d x 240h, 1-100rpm	1	Newly required by revision of curriculum
	Thermostatic water circulation set	Bath 3m^3, Pump 400W, Heater 3kw, Freezer 0.4kw	1	Obsoleteness due to remodeling since years
	Strain gauge measuring systen	Strain gauge amplifier, strain indicator, calibrator, elongation meter	1	Addition to the existing equipment which is short in quantity
	Data logger	Automatic recording of the measurements through the last item and other applicable meters.	1	Newly required by revision of curriculum
	Scanner	Enforcement to the last item, data logger. Max scanning 50 channels	1	Newly required by revision of curriculum
	Fluid Mechanics and Environmental Lab.			
	Two dimensional wave generator	500w x 750d, wave height 200 or higher, wave period 1- 2.5sec, power ca 4kW	1	Obsoleteness due to remodeling since years
	Free and Forced Vortex Apparatus	Tank 245mm dia x 180mm depth	1	Obsoleteness due to remodeling since years

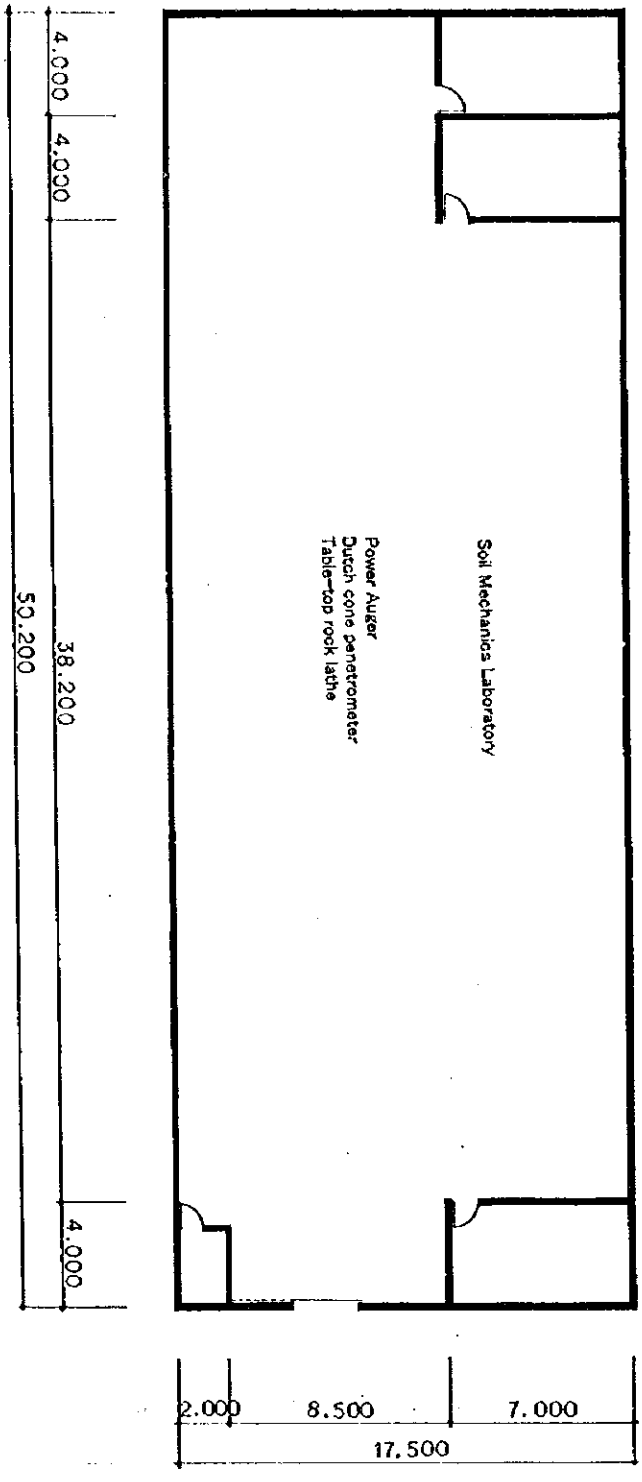
Item	Description	Specifications	Q'ty	Reason for selection
	Pump performance test bench	Volute pump 0.15m³/min, suction -76 cm-0, discharge 0-3kg/cm²G	1	Obsoleteness due to remodeling since years
	Survey Lab.			
	Color GPS Video Plotter of lesser resolution	Accuracy ca. 15m or smaller	1	Newly required by revision of curriculum
	Total Station	Telescope ca. 30x, accuracy 5 second	1	Deterioration by equipment life expiration
	Soil Mechanics Lab.			
	Power Auger	Motor operated auger. Performance 10 m depth or more. Sample diameter 75mm	1	Deterioration by equipment life expiration
	Dutch Cone Penetrometer	Maximum press-in forth: 10tonf.	1	Newly required by revision of curriculum
	Table-top Rock Lathe	60mm chuck, opening 150mm.	1	Obsoleteness due to remodeling since years
	Structure Lab.			
	Data acquisition and control system for large scale structural testing facility	Load cell(up to100ton), Data logger, speed and acceleration sensor, transducer(range of acceleration 0.5 to 100 Hz), monitoring unit, strain gauge	1	Addition to the existing equipment which is short in quantity
	Industrial grade video camera system capable of high frame rate	1000frames	1	Newly required by revision of curriculum
3. MECHANICAL ENGINEERING				
	Thermal conductivity measuring apparatus	Up to 2.0W/m°K, Stationary type	1	Addition to the existing equipment which is short in quantity
	Forced convection heat transfer apparatus	Including turbulent flow in pipe	1	Deterioration by equipment life expiration
	Air compressor test unit	7kg/cm²G	1	Addition to the existing equipment which is short in quantity
	Data acquisition terminal	with remote scanner of 50cannels	1	Obsoleteness due to remodeling since years
	Thermal conductivity meter	Up to 0.05-5.00W/m°K, Stationary type	1	Addition to the existing equipment which is short in quantity
	Refrigeration/air conditioning training equipment	Components: Compressor, condenser, fan and evaporator	1	Obsoleteness due to remodeling since years
	Potentiostat galvanostat	Output max. +-50V	1	Newly required by revision of curriculum
	Industrial microscope with camera	magnifying50-1000, with 25mm camera.	1	Addition to the existing equipment which is short in quantity
4.PRODUCTION ENGINEERING				
	Conveyor loop, Vision system and Interface unit, Pick & place robot	perpendicular multi-joint robot with hands, belt conveyer with optical sensorr and relay-switch. CNC machine tool.	1	Newly required by revision of curriculum

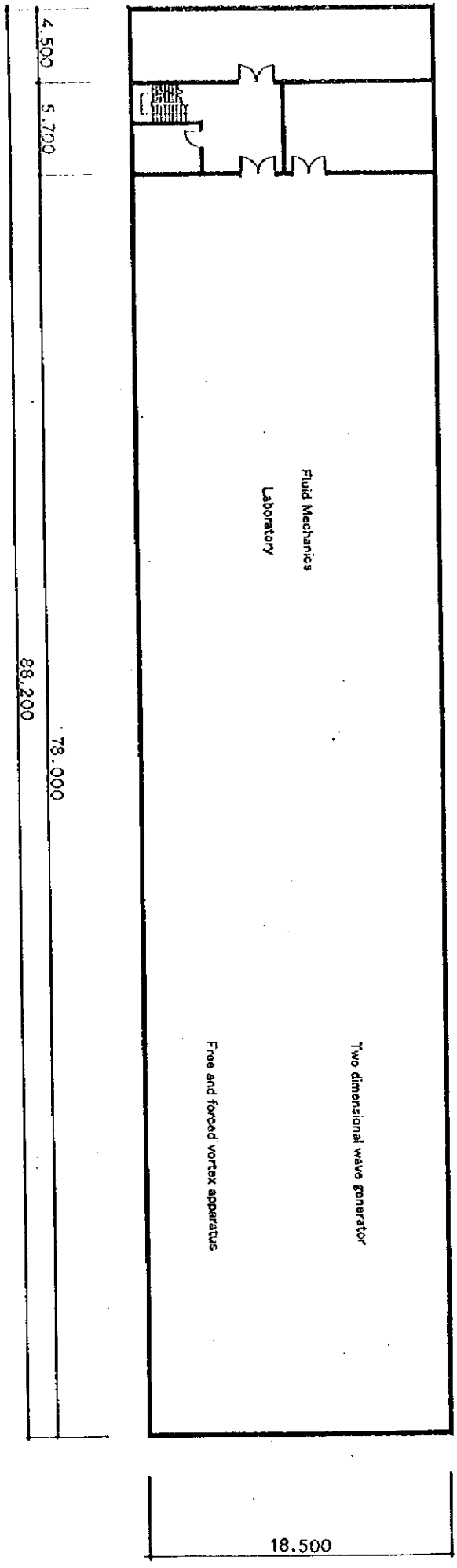
Item	Description	Specifications	Q'ty	Reason for selection
	Mini N/C Milling Machine, Mini N/C Lathe Machine with CAM Program Link software	N/C lathe 1, N/C milling machine 1	1	Newly required by revision of curriculum
	CNC Machining Center	Work table: ca1800x800mm, axle movement: ca 1000x800x 800mm, spindle speed : 8000rpm	1	Obsoleteness due to remodeling since years
	Numerically controlled turning center	swing overhead 500mm, swing over cross slide 350mm, center to center 1000mm	1	Obsoleteness due to remodeling since years
	Surface roughness measuring machine, analyzer, printer & recorder	with analyser, printer, recorder, measurement 8 μ m, accuracy 0.001 μ m	1	Obsoleteness due to remodeling since years
	Piezo-electric crystal dynamometer, amplifier and accessories	3 component motor meters for lathe and milling machine	1	Obsoleteness due to remodeling since years
	Portable FFT analyzer	Measurement of acceleration, speed and displacement	1	Obsoleteness due to remodeling since years
	Motion control hardware	5 motors and encoder	1	Addition to the existing equipment which is short in quantity
	Instrumentation Lab equipment (Printer Circuit Board Making Kit)	UV exposure unit, PCB drill, PCB shear, disordering station, tester, pattern generator, variable	1	Obsoleteness due to remodeling since years
	Pneumatic system	Training of control for cylinders and valves equiped with sensing device; UV	1	Obsoleteness due to remodeling since years
	Hydraulic system	Training of control for actuator and automatic sequence control	1	Obsoleteness due to remodeling since years
5. ENGINEERING MATHEMATICS				
	Computer image projection system	For 320 person classroom. IBMPC compatible, 64 or more colors	2	Addition to the existing equipment which is short in quantity
6. COMPUTER SCIENCES				
	Logic analyzer	96channels, 16MHz,	1	Newly required by revision of curriculum
7. ELECTRICAL AND ELECTRONIC ENGINEERING				
	Waveform analyzer 30 Hz-16 kHz	30Hz~16KHz	1	Obsoleteness due to remodeling since years
	Communication Lab.			
	Field Strength meter (25 Hz to 1700 MHz)	Measurement up to 1700MHz	2	Addition to the existing equipment which is short in quantity
	Noise figure measurement systems	Measurement up to 30dB, input frequency 2000MHz	1	Newly required by revision of curriculum
	Network analyzer	Frequency 10 - 30MHz	2	Addition to the existing equipment which is short in quantity
	Antenna modeling/testing system 1 Hz range	Up to 1GHz	1	Newly required by revision of curriculum
	VSWR(variable standing wave ratio) meter upto 1GHz	Up to 1GHz	3	Addition to the existing equipment which is short in quantity
	Error rate measurement system for digital communication	Simultaneous display and statistical processing of errors,	1	Addition to the existing equipment which is short in quantity

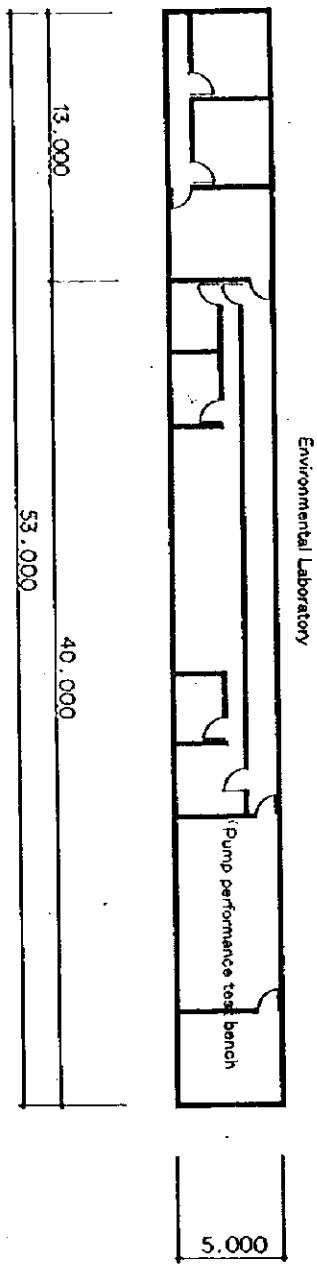
Item	Description	Specifications	Q'ty	Reason for selection
	Digital communication teaching kit	Combination of FSK, PSK, ASK modulation/demodulation and transmission	1	Addition to the existing equipment which is short in quantity
	Antenna demonstration kit	Demonstration of Nathan functioning in 5 types for training	1	Newly required by revision of curriculum
	RADAR Demonstration/Experimental kit	Input 10 — 40V, peak 4kW, frequency +-30MHz	1	Addition to the existing equipment which is short in quantity
	Telecommunication Training system	10Hz-100MHz analog and digital communication teaching kit. Incl. of software, signal source, tuner, AM & FM	1	Newly required by revision of curriculum
	Electrical Power Lab.			
	Protective relays of various types	Overcorrect relay, differential relay, range 1A-5A, 0.05-100SEC	1	Obsoleteness due to remodeling since years
	Calibration Equipment Lab.			
	DC voltage current standard	10V DC, 8micro volt noise	1	Addition to the existing equipment which is short in quantity
	AC voltage current standard	output 30V, range 1mV— 1200V AC, frequency50, 60, 400Hz	1	Addition to the existing equipment which is short in quantity
	Digital electronic Lab.			
	Logic analyzer 400 MHz	80 channels		Obsoleteness due to remodeling since years
8. LANGUAGE LAB				
9. CHEMICAL ENGINEERING				
	Ultra high temperature muffle furnace	1900°C max	1	Obsoleteness due to remodeling since years
	Continuous flow centrifuge	3000rpm, 30 l/hr	1	Obsoleteness due to remodeling since years
	Pressure homogenizer	700 l/h, pressure: 100 to 500atm	1	Obsoleteness due to remodeling since years
	Atomic absorption spectrophotometer	Flame system, wave length: 190nm～800nm(arsenic to potassium)	1	Obsoleteness due to remodeling since years
10. COMPUTING CENTER				
	Uninterrupted power supply	30KVA, backup ca. 10minutes	1	Addition to the existing equipment which is short in quantity
	Heavy duty line printers	900 lines/min	1	Addition to the existing equipment which is short in quantity
	plotters	Size:A1	1	Addition to the existing equipment which is short in quantity
	PC Server		1	Addition to the existing equipment which is short in quantity

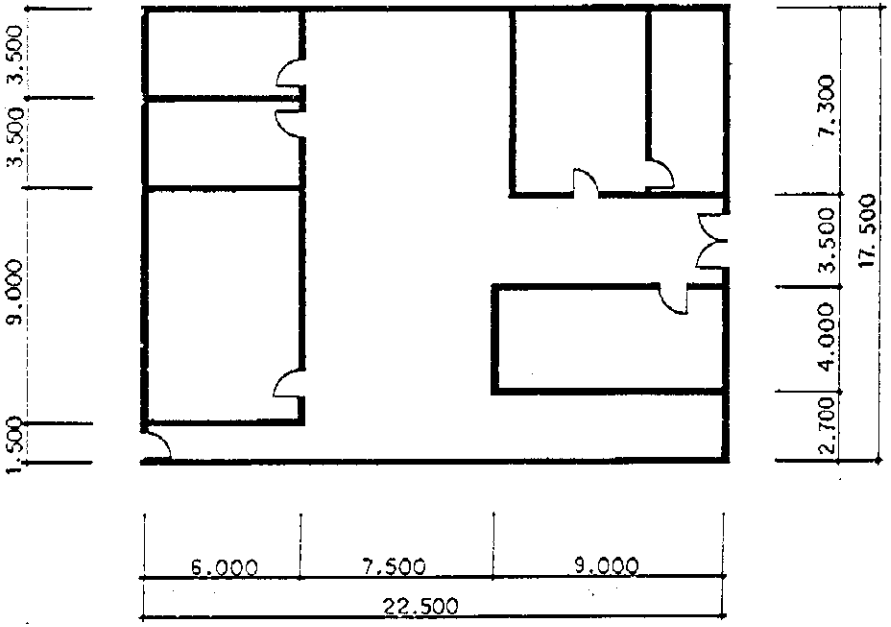
Figure 2 - 2 Layout Plan




4.000
4.000
38.200
4.000
50.200
Soil Mechanics Laboratory
Power Auger
Dutch cone penetrometer
Table-top rock lathe
2.000
8.500
7.000
17.500


4.500
5.700
88.200
78.000
Fluid Mechanics
Laboratory
Two dimensional wave generator
Free and forced vortex apparatus
18.500

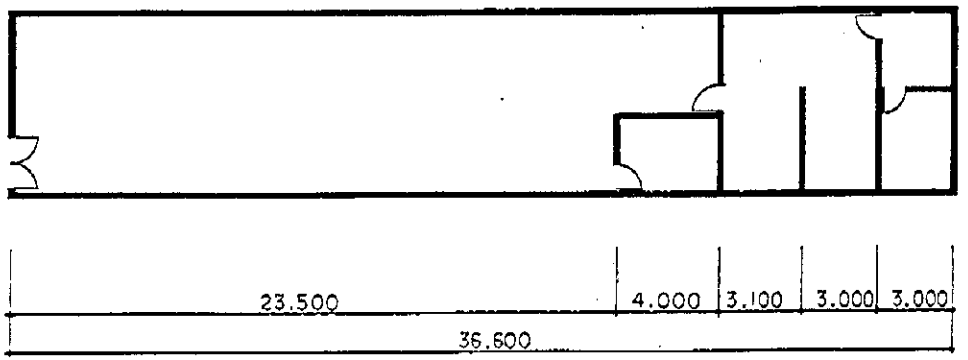

13.000
53.000
40.000
Environmental Laboratory
Pump performance test bench
5.000



Survey Laboratory

Color GPS video plotter of lesser resolution

Total Station



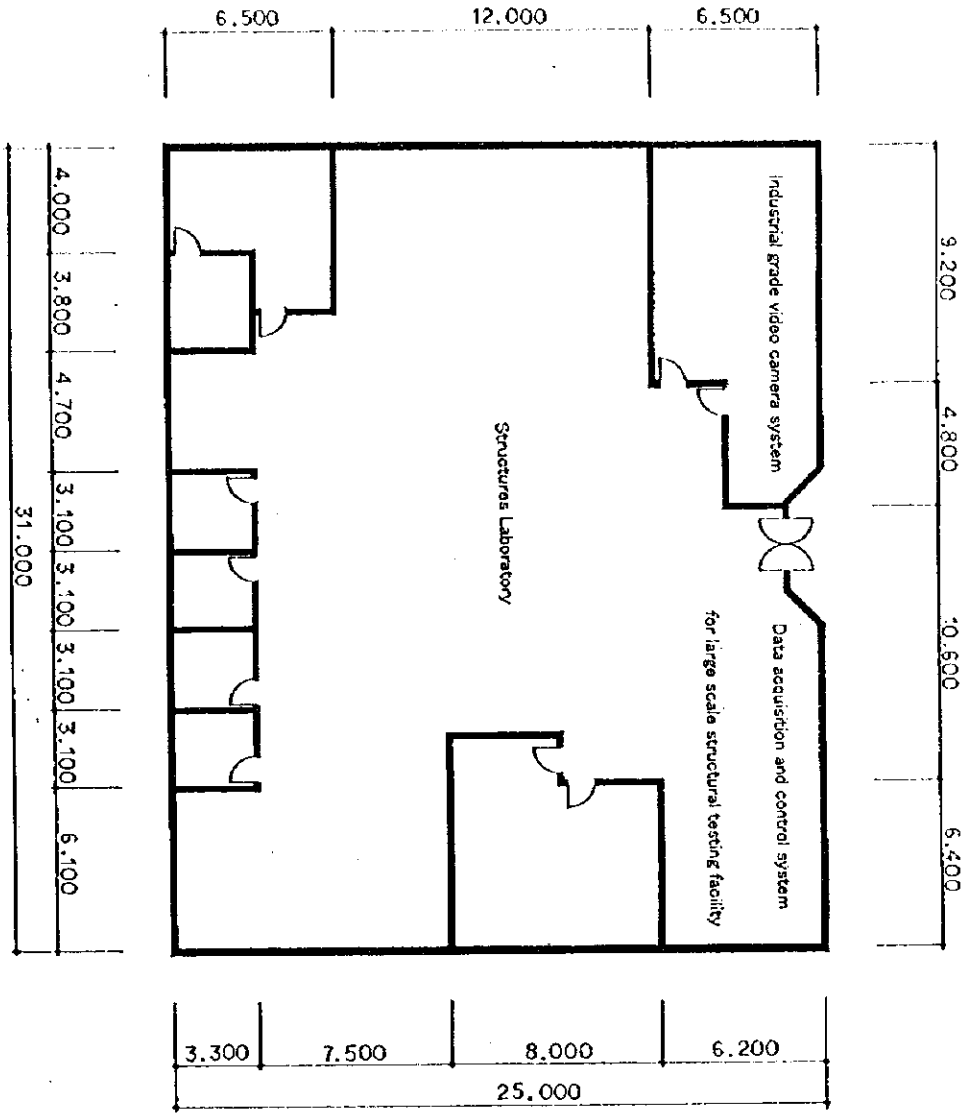
Metallurgy Laboratory

Nondestructive testing apparatus

Micro hardness tester
Vickers hardness tester

High temperature furnace

Metallurgical microscope with camera arrangements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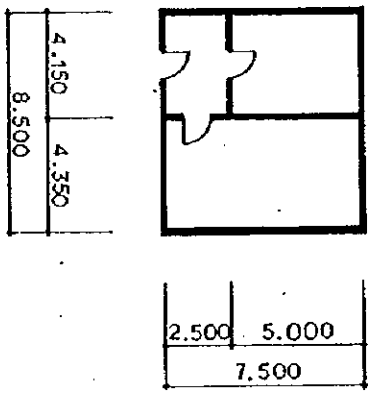
6.500
4.000
3.800
4.700
3.100
3.100
3.100
3.100
6.100
31.000
9.200
4.800
10.500
6.400
Industrial grade video camera system
Structures Laboratory
for large scale structural testing facility
Data acquisition and control system
3.300
7.500
8.000
6.200
25.000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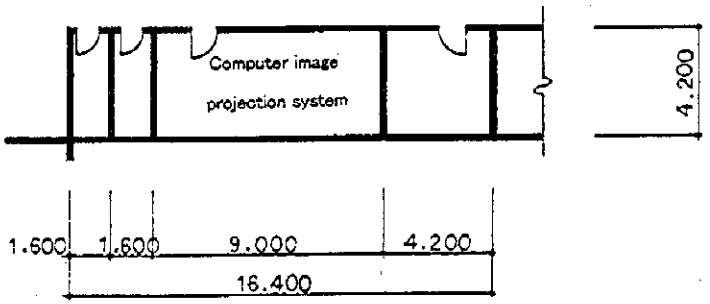
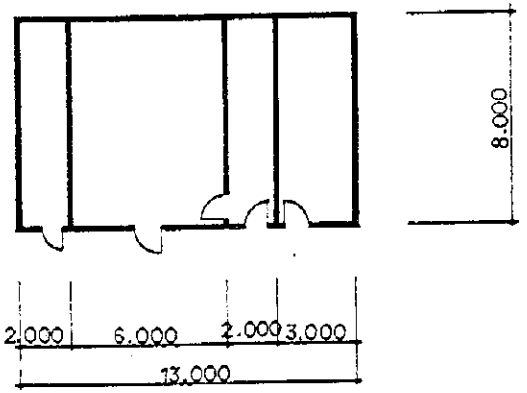
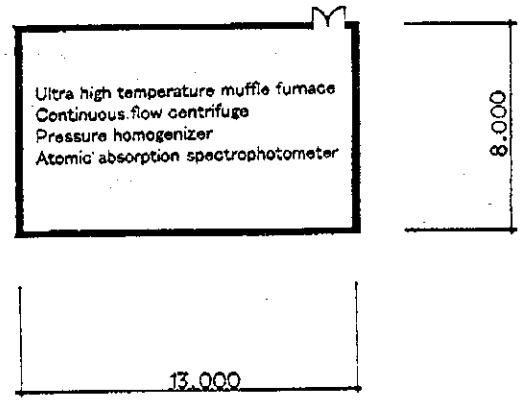
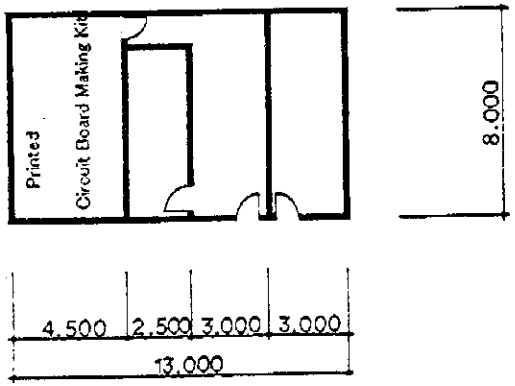
7.500



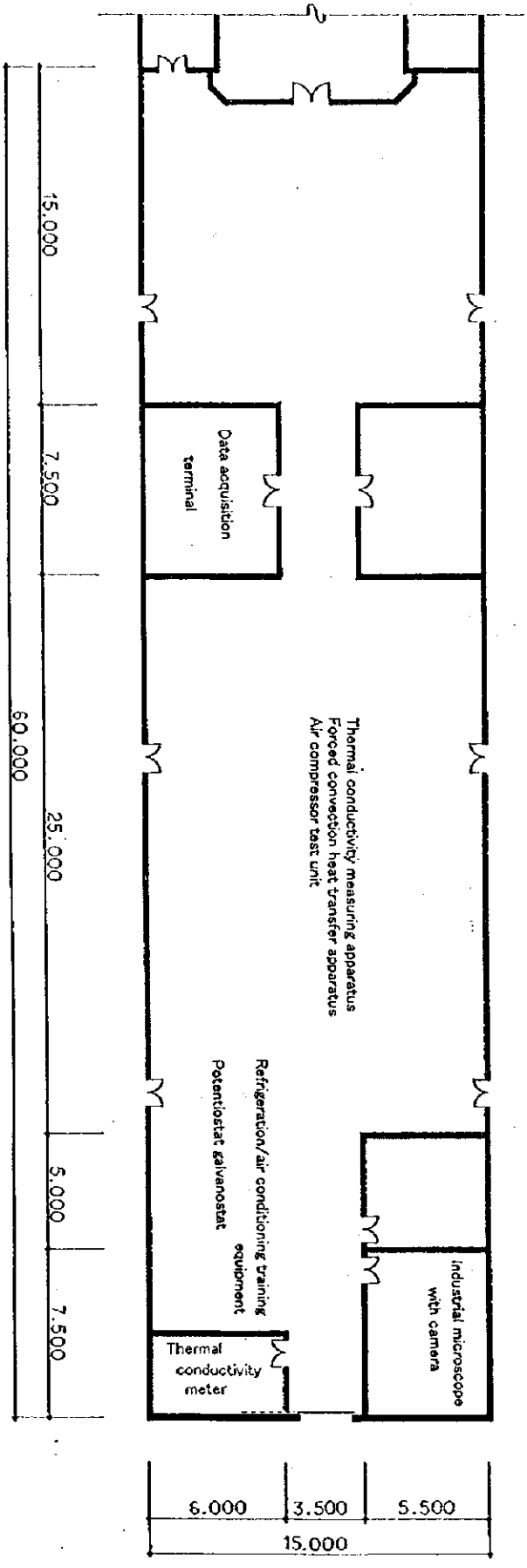
ENGINEERING MATHEMATICS DEPARTMENT







CHEMICAL ENGINEERING DEPARTMENT



MECHANICAL ENGINEERING DEPARTMENT

Conveyor loop, vision system and interface unit, pick & place robot

Mini N/C milling machine with CAM program link software

CNC machining center

Numerically controlled turning center

Surface roughness measuring machine, analyzer, printer & recorder

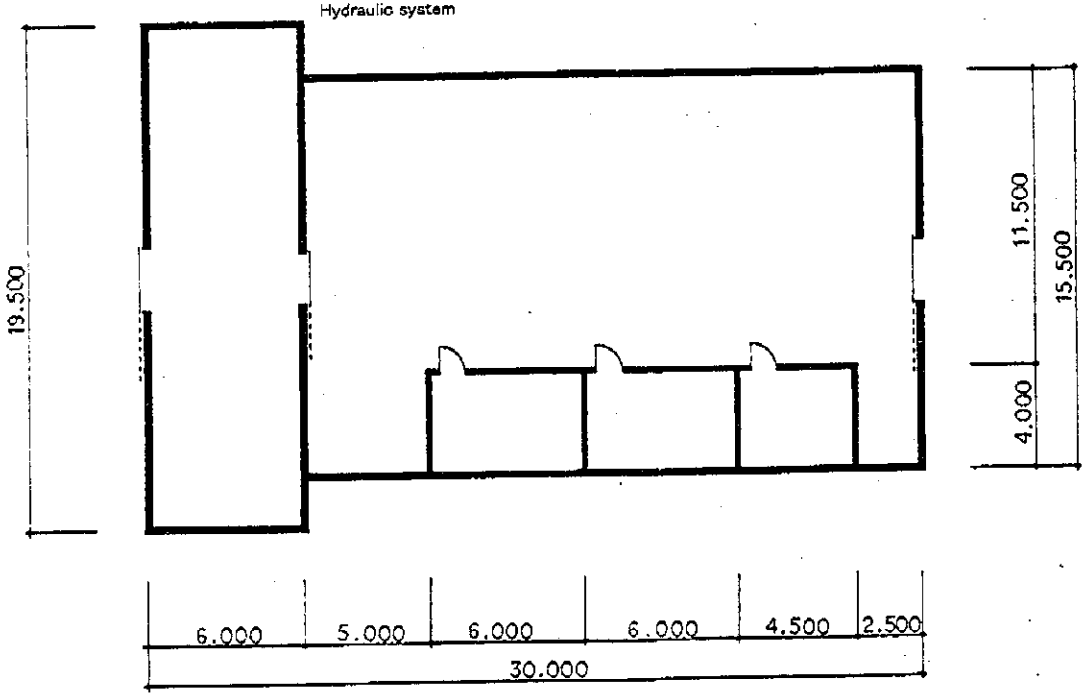
Piezo-electric crystal dynamometer, amplifier and accessories

Portable FFT analyzer

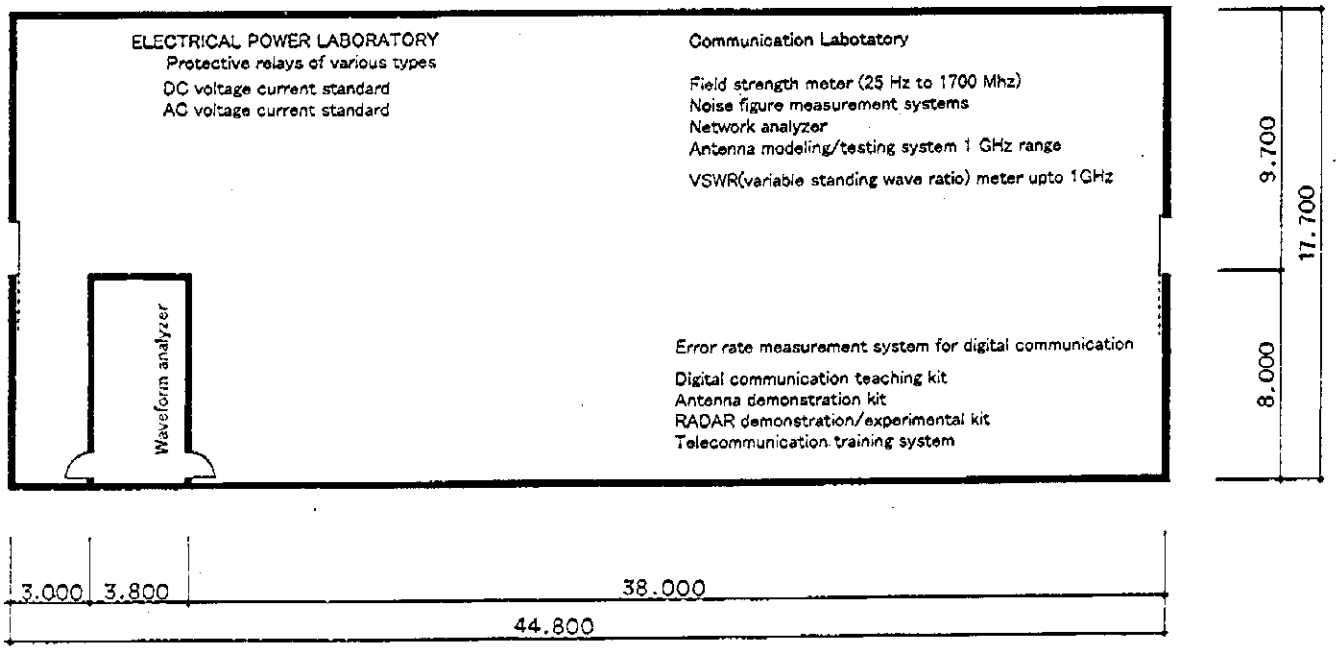
Motion control hardware

Pneumatic system

Hydraulic system



PRODUCTION ENGINEERING DEPARTMENT



ELECTRICL AND ELECTRONIC ENGINEERING DEPARTMENT

CHAPTER 3 IMPLEMENTATION PLAN

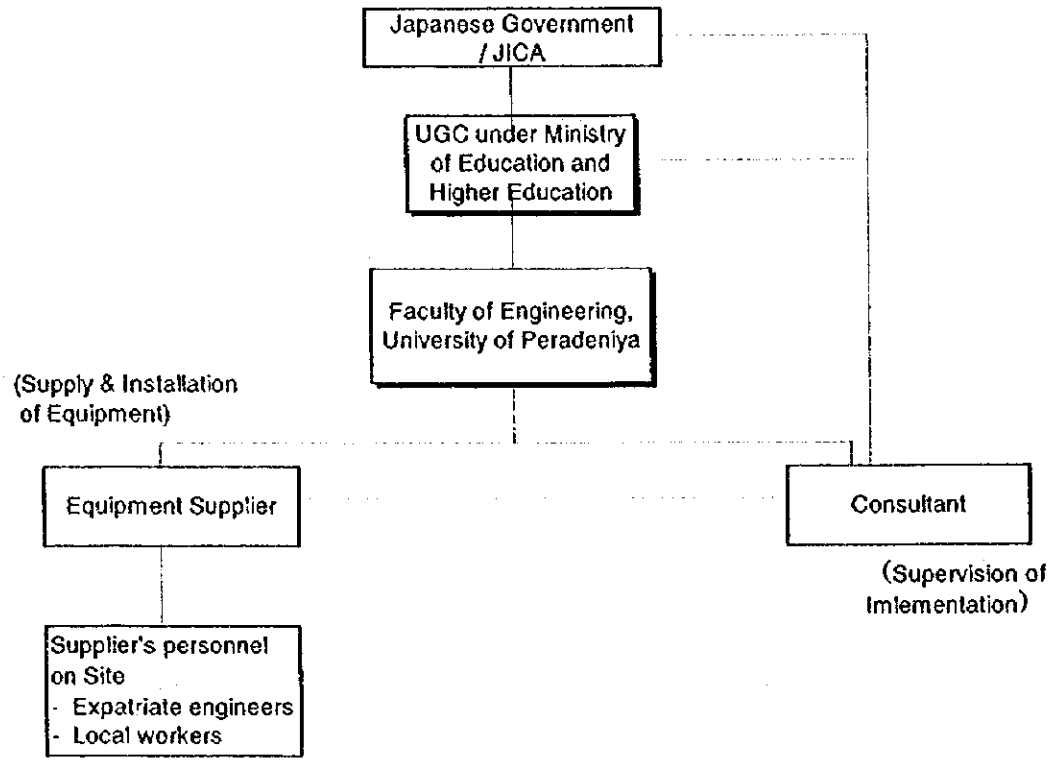
CHAPTER 3 IMPLEMENTATION PLAN

3-1 Implementation Plan

3-1-1 Implementation Concept

In the implementation stage, the Faculty of Engineering, University of Peradeniya as the project executing agency will commission to a Japanese consultant detailed design, preparation and distribution of tender documents, tender evaluation and supervision of equipment installation. The university will also enter into contract with a contractor who will procure, transport and install equipment and instruct operation and maintenance methods and procedures to the university's staff. In the installation stage, unpacking and installation will be carried out by local workers under the supervision of Japanese engineers assigned by the contractor. Then, wiring, the fitting of accessories and parts, commissioning, and adjustment will be made by responsible engineers of the contractor. A general organization of the installation and related work is shown in Fig.3-1 on the next page.

Figure 3-1 Project Implementation Organization



3-1-2 Important Considerations in Project Implementation

Equipment designed for the project does not require export licenses from the Japanese Government when export to Sri Lanka. However, it is recommended to take consideration on the following issues:

- Constraint in the construction period
  Since the Project is vested with a slightly shorter construction period, close communication and arrangement among JICA and the consultant team and the University of Peradeniya, the executing organization of the responsible organization of Sri Lanka (hereinafter referred to as "the executing organization") is requested.

- Planning adapted to the site conditions
- No equipment within those requested by Sri Lanka has its specification prone to be affected by quality of water of the Project Site. Power failures take place at the

Plant Site notwithstanding that power supply in Sri Lanka has been stable. An abrupt power failure affects on computers. It results in deficiency to computer-related educational activities through making memories lost. Therefore, an installation of un-interruptible power system (UPS) in the Computer Center of the executing organization is called for.

3-1-3 Scope of Works

Sri Lanka Side (as required):

① Interior work of buildings
② Electric work for power receiving and distribution
③ Water supply and drainage work
④ Electric lighting work
⑤ Ventilation work
⑥ Procurement of furniture and fixtures
⑦ Procurement of chemicals and consumable

Japanese Side

① Procurement, transportation, delivery and installation of equipment to be supplied
② Secondary wiring
③ Test operation and adjustment of equipment, training in operation and maintenance of major equipment
④ Consulting service related to detailed design, preparation of tender documents, management of tender, and supervision of project implementation

3-1-4 Consultant Supervision

Based on the grant aid policy of the Japanese government and the consulting agreement, the consultant will be required to organize a project team to carry out detailed design and work supervision on the basis of principles and criteria set in the basic design process, thereby to implement the project on schedule to its completion. The project team will consist of six members, including five engineers who will be responsible for overall management, equipment planning in

mechanical and metallurgical fields, equipment planning in electrical and electronic fields, equipment planning in civil engineering and mining fields, and equipment planning in the fields of physical and chemical analyses (including chemical engineering and petroleum engineering), and one specialist responsible for estimation of the project costs. The consultant will, in a neutral position, finalize in consultation with the executing agency detailed specifications for equipment to be supplied and draft tender documents, followed by tendering and application for approvals and permits of the Japanese government. In the tender evaluation and negotiation process, the consultant will assist the representative of the executing agency to ensure a smooth progress of the project. At the supervision stage, the consultant will provide technical assistance for the executing agency in relation to the approval of drawings in Japan, followed by attendance and supervision during shop inspection, installation, and delivery. The consultant's engineer will supervise the installation, acceptance, and delivery at the project site.

3-1-5 Procurement Plan

(1) Procurement method

Equipment which requires maintenance or repair of its manufacturer or supply of spare parts, such as electrical and electronic equipment, should be made by manufacturers who have branch offices or agents in Sri Lanka and provide maintenance and repair service, regardless of country of origin. In particular, the following types of equipment must be locally procured.

Equipment which requires maintenance or repair of its manufacturer or supply of spare parts, such as tape recorders and computers, are recommended to procure locally in order for the Faculty become convenient to proper maintenance. However, equipment locally procured will be subjected to import duties and business turnover taxes. Therefore, it is necessary to take necessary measures to exempt these duties and taxes. Other equipment who have branch offices or agents in Singapore, it is also recommended to procure there because of the easy access to Sri Lanka.

(2) Transportation

Containers will be landed at Colombo Port. Distance from the landed port to the project site is 116km.The main road is completely paved though it has up and downs when it comes to the destination. Therefore, there are no difficulty to transport. It is recommendable to use container for delivery because there are 10 sub-destination(department) and also they are sub-divided into more small classifications as laboratories.

3-1-6 Implementation Schedule

(1) E/N and Detailed study at site

Following the completion of E/N, the consultant will visit recipient country for consulting agreement and to implement detailed study at site. During the detailed design study, the consultant will explain the intent of Basic Design Study Report and start meeting to confirm detailed design. Also, the consultant will make sure of the condition of inland transportation route and the condition of buildings and laboratories where new equipment is scheduled to installed.

(2) Detailed Design and Tendering

The consultant will, based on the intent and the result of detailed study, prepare document for tendering and open tendering upon approval from the Sri Lanka side. It will take 4.5 months approximately.

(3) Manufacturing and Supervisory

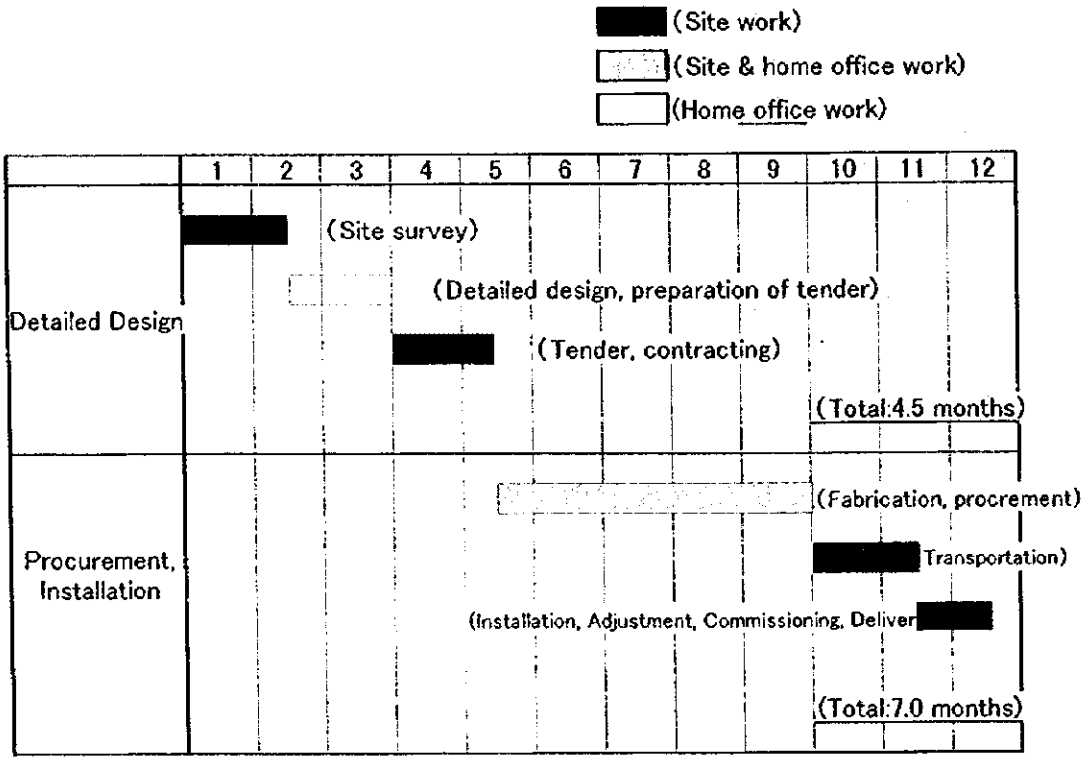
At the manufacturing and supervision stage, the consultant will provide technical assistance for the executing agency in relation to the approval of drawings in Japan, followed by attendance and supervision during shop inspection, installation, and delivery. Then, the executing agency will start place order to the manufacturers and shipping. The executing agency will also responsible for overall site services relating to the supply of equipment such as delivery, installation, adjustment, operation training and commissioning.

(4) Completion of Construction

At the supervision stage, The consultant's engineer will supervise the installation, acceptance, and delivery at the project site.

After equipment is delivered or installed, under the supervision of both consultant and representative of the Sri Lanka counterpart, the executing agency has to instruct test operation or visible inspection based on the accord on the supply contract. The project will complete on condition that the receipt of completion certificate by the counterpart. The project will complete in 7.0 months approximately if the construction procedure goes smoothly.

Implementation schedule is listed in Figure 3-2.



3-2 Implementation Schedule

3-1-7 Obligation of Recipient Country

Services provided by the Sri Lanka side are indicated below.

1) To provide necessary information and data to the consultant who are to execute consulting services for the implementation stage.
2) Interior work, foundation work for equipment installation base, relocation of existing equipment within the building.
3) Power receiving, transformation, wiring work.
4) To take necessary procedures for the unloading, custom's clearance and inland transportation of equipment, and to bear all the expenses required by the procedures.
5) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in Sri Lanka with respect to the supply of the goods and services under the verified contracts.
6) To accord Japanese nationals whose service may be required in connection with the project such facilities as may be necessary for their entry into Sri Lanka and stay therein for the performance of their work.
7) To bear commissions to an authorized foreign exchange bank in Japan for the banking services based on the Banking Arrangement.
8) To maintain and use properly the equipment improved under the Grant Aid. Also, to allocate enough staff and budget to maintain the equipment properly.
9) To bear all other expenses that are not covered by the grant aid but may be necessary to carry out the project

3-2 Operation and Maintenance Plan

Twenty three personnel exclusive of unskilled labors are staffed for technical administration and maintenance of the executing organization now. Maintenance of existing equipment has been performed in a satisfactory grade with those personnel. Also, the senior academic staff are quite active in cooperating with and advising the maintenance crew when problems in sophisticated equipment take place. The said aspect seems to comprise an advantage of the faculty of engineering to other faculties.

There will be no necessity to hire additional maintenance staff due to the increase of equipment under the Project. This observation is justified with the following facts. Most equipment to be provided for the Project are mostly those for renewal of deteriorated existing equipment or for addition to cover increased number

of student or due necessity. In addition, new equipment are basically with specifications requiring considerably small maintenance works, and further shall be selected in the detailed design stage making much of the least requirement for maintenance. It must also be mentioned that the staff for maintenance is evaluated as satisfactory in terms of technical competence as well as size of the crew. Provisions for and administration of the consuming materials are being performed efficiently. The maintenance department is evaluated as a whole as sufficiently reliable.

Increase of utilities consumption resulted from the Project will occur for electric power only. No significant additional costs for water and steam will take place as no equipment calling for them has been planned in the Project.

For making a forecast of maintenance expenses, first it must be noted that the utility costs are borne by the University Headquarters as a whole. Therefore, the budget for the faculty of engineering does not include them.

According to the Project schedule to provide all the equipment in 1998, services of them will commence in some month in spring season 1999. Naturally, educational activities using the existing equipment shall continue up to that commencement. This may result in some increase of maintenance expenditures to cope with progress of deterioration during the said period, especially in terms of repair work and replenishment of spare parts and materials. The same will apply in a forecast of personnel requirement; a slight increase of workload may occur, but it will remain within a range of intensity that can be managed with the current system. The additional requirement to the entire amount of the expenditures for the said period, therefore, may only be resulted from additional procurement of the parts and materials.

In and after the spring season 1999, the expenses for maintenance of the equipment provided through the Project are forecast as follows (as 1 US$ =SL Rs 61, 1US$=J¥124.00):

Procurement of maintenance materials:

J¥640,000 (J¥ 0 for the first year: 1999)

Other expenses for administration and maintenance:

J¥840,000 (J¥410,000 for 1999)

The faculty has a mind to apply to UGC of its expenses budget for equipment repair and maintenance of materials for the newly provided equipment for 1999, with an increase by 20% from that for 1998. The increase from 1997 to 1998 marked 14.5%. If the expenses increase 1998 to 1999 remains in the identical rate, an amount for the balance, 6%, is to be allocated for the new equipment. This amount is evaluated to cover maintenance expenditures for the new equipment due to the Project. Consequently, taking account of low failure rates of the existing equipment in recent years, no question over the budgetary provision for maintaining the equipment by the Project will arise. The said application to UGC will be made in June or July 1999 after the equipment detail design is concluded. This schedule enables the executing organization to have a sufficient time for budget preparation. In addition, with regard of the UGC position that has been making necessary supplement for the executing organization, there is no problem forecast about availability of the said terms of the budget.

CHAPTER 4 PROJECT EVALUATION AND RECOMMENDATION

Chapter 4. Evaluation of the Project and Recommendations

4-1. Project Effect

The following effects from the project are expected.

(1) Improvement of education environment

The team expect that the improvement of equipment will benefit the education environment for about 300 students every year. Existing equipment can continue services but are coming obsolete. Experiments and exercises using such obsolete or old equipment do not give deep study and not demonstrative, as a matter of fact. Further, the shortage of the whole equipment makes it difficult for many students to do exercise directly using them. In this way, the education in the Faculty of Engineering, the University of Peradeniya, is becoming distant from more practical, solution-oriented education required at actual production workplaces. Education there is becoming away from the broader national plans "to bring up engineers who can meet the needs of industries" and "to bring up engineers who can catch up with advanced technologies to lead the future industries." By providing the planned equipment to meet these challenges, students will be able to master scientific research methods in willing and demonstrative manners and improve technique and knowledge. Also, they will be able to engage in more practical activities in industrial sectors employing them after graduation.

As a result of interviews on the graduates' employers, the team found that about 65% of the graduates are employed by industries such as electricity, communications, construction, civil engineering, chemicals and foods (about 25% are government employees). The students employed by such industries will be able to contribute to the whole industries by modernizing firms in their positions as senior engineers guiding such firms, based on practical experiences using the equipment introduced according to the Project. Especially, as the Faculty of Engineering, the University of Peradeniya, supplies 50% of the senior engineers in Sri Lanka and contribute to the growth of these sectors, the grant aid will have much benefiting effects.

(2) Widespread Effects

The Faculty of Engineering admits trainees from the society numbering about 200-300, although the number may change year to year. At the Faculty, they join on-the-job training for operating equipment and lectures and exercises to learn higher technology and engineering knowledge (for qualification). When these worker-trainees return to their workplaces, they can contribute to the production activities of their employers in more practical manners, based on the experience with the equipment provided with the Project. Further, it will have widespread effects on the colleagues of same employers.

(3) Reduction of Recurrent Costs

The grant aid will provide virtually maintenance-free equipment and new ones, resulting in reduction of annual recurrent costs to be borne by the Faculty of Engineering. The Faculty spent about 100 thousand US dollars for repair and maintenance of equipment for these three to four years. 90% of the existing equipment have been used for 15 years or more and are becoming older day by day. It is expected that the costs for repair and maintenance will be greater as a result. With improved equipment, the Faculty will be able to purchase foreign technical documents and literature and start improving software, which were necessary but could not so far been afforded due to limited budget. Further, the Faculty will be able to secure and properly allocate budgets for the staff engaged in maintenance/management of equipment, and also to maintain and manage equipment in more sufficient manners. Therefore, the grant aid will improve not only the direct educational effects with the improvement of materials but also some secondary educational effects.

Because the appropriateness and practicability of the plan as well as the Faculty 's ability for implementation are confirmed, it is desirable that the plan will be implemented with the grant aid of Japan.

4-2. Technical Assistance/Collaboration with Other Donors

There is no request for the Project Type Technical Cooperation regarding the project. However, as mentioned above, the ADB is planning to implement a "project for developing scientific, technological and human resources" to bring up human resources and strengthen research functions. Therefore, the team should fully consider the mutual supplementation between the project and the ADB project to promote development of the Faculty of Engineering, the University of Peradeniya.

4-3. Recommendation

(1) Increase in the Number of Instructors

The Faculty of Engineering has 141 instructors at present which fill only about 50% of the regular positions. The improvement of equipment with the grant aid will enable demonstrative education through experiments and exercises for students and dependency on lectures or the dilemmas of instructors will be improved. It is considered necessary to actively increase the number of instructors with the cooperation of UGC.

(2) Funding for maintenance/management costs and managing staff

The table of changes in annual budgets and expenses in the Faculty of Engineering, the University of Peradeniya, shows that the total maintenance/management costs for fiscal 1998 will amount to about 40 thousand US dollars. The university intends to apply for increase in the next fiscal year, taking into account the increase by newly provided materials with the grant aid. However, there will be no repair costs within one year from delivery of materials or equipment or the warranty period of the contractor. Further, it is expected that they can save a budget for new equipment because the grant aid provides them. It is up to the proper and sufficient maintenance and management whether or not the provided equipment will be effectively utilized over a long term. Therefore, the balance of the budget and the expense can be used for strengthening maintenance and management systems. If, for example, the budget for maintenance and management staff is secured and properly allocated, equipment will be maintained and managed in more sufficient manners.

(3) Widespread effects for industries

To increase the benefits of improved equipment by the project, the Faculty of Engineering may increase numbers of worker-trainees (for on-the-job training on operation of machinery as well as exercises and experiments for learning higher technologies and engineering knowledge), which is expected to promote practical and direct contributions to the industries. These trainees are also sources of revenue other than the government budget. Such additional revenue may be used for maximizing education effects for example by improving of library and software as well as supplementing research costs. For such purposes, it is important to make systems for efficient education by small number of instructors and also to increase instructors.

APPENDICES

(3) Widespread effects for industries

To increase the benefits of improved equipment by the project, the Faculty of Engineering may increase numbers of worker-trainees (for on-the-job training on operation of machinery as well as exercises and experiments for learning higher technologies and engineering knowledge), which is expected to promote practical and direct contributions to the industries. These trainees are also sources of revenue other than the government budget. Such additional revenue may be used for maximizing education effects for example by improving of library and software as well as supplementing research costs. For such purposes, it is important to make systems for efficient education by small number of instructors and also to increase instructors.

APPENDICES

1. Member list of the survey Team

1) Leader

Mr. AKIRA HARA

Development Specialist for Human Resources Development

Japan International Cooperation Agency (JICA)

2) Project Coordinator

Ms. EIKO IZAWA/Education Administration Analyst

Associate Expert (Education / Human Resource Development)

Second Project Study Division, Grant Aid Project Study Department

Japan International Cooperation Agency (JICA)

3) Chief Consultant & Operational and Maintenance Planner

Mr. HIROFUMI YAMAUCHI

UNICO International Corporation

4) Engineering Education Planner

Mr. TAKASHI KURODA

UNICO International Corporation

5) Equipment Planner

Mr. MINORU UMEOKA

UNICO International Corporation

6) Procurement Planner / Cost Estimator

Ms. KAZUKO YAMAGATA

UNICO International Corporation

2. Survey Schedule

No.	Date	Day	Itinerary		
			Official member	Consultants	
				Leader	Others
1	98/1/07	Wed	Lv.Tokyo -Arr. Singapore(12:00 -18:20 by SQ997) Lv.Singapore - Arr. Colombo(21:00 - 22:40 by SQ402)		
2	08	Thu	Courtesy calls to JICA Colombo Office, Embassy of Japan(EOJ), Ministry of Education(MOE), Move to Kandy (P.M.)		
3	09	Fri	Site survey and meeting at University of Peradeniya(UP)		
4	10	Sat	Discussion with UP		
5	11	Sun	Move to Colombo		Site survey at UP
6	12	Mon	Team Meeting		
7	13	Tue	Discussion with ADB, MOE, UP		
8	14	Wed	Discussion with MOE, UP		
9	15	Thu	Signing the Minutes of Discussions with UP and MOE (A.M.) Report to JICA, EOJ Lv.Colombo 23:55 by SQ401		
10	16	Fri	Arr Singapore at 05:50 Lv Singapore 23:30 by NH902	Local agent survey	
11	17	Sat	Arr. Tokyo at 06:55	Move to Kandy	
12	18	Sun			
13 - 20	19 - 26				
21	27	Tue		Report to JICA,EOJ Lv. Colombo 23:55 by SQ401	
22	28	Wed		Arr Singapore at 05:50 Lv.Singapore - Tokyo(08:25-15:45 byJL712)	

3. List of Party Concerned in the Recipient Country

DEPARTMENT OF CIVIL ENGINEERING

Prof. M.P. Ranaweera (Ph.D., Cambridge, UK)
Prof. K.G.H.C.N. Seneviratne (Ph.D., Cambridge, UK)
Dr. H.H.J. Keerthisena (Ph.D., Peradeniya, Sri Lanka)
Dr. G.E. Amirthanathan (D.Eng. Montepellierll, France)
Dr. S.V.M. Fernando (Ph.d., U of Miami, USA)
Dr. A.P.N. Somaratna (Ph.D., U of Miami, USA)
Mr. U. de S. Jayawardena (MSc., U of New Castle Upon Tyne, UK)
Dr. K.R.B. Herath (Ph.D., UCSB, California, USA)
Dr. A.L.M. Mauroof (Deng., U of Tokyo, Tokyo)
Dr. A.G.J.H. Edirisinghe (Ph.D., Ehime University, Japan)
Dr. K.D.W. Nandalal (Ph.D., Wageningen, Netherlands)
Dr. Mrs. P. Wedage (Ph.D., Alta, USA)
Dr. S.B. Weerakoon, D.Eng., Tokyo)
Dr. U.R. Ratnayake (D.Eng., AIT, Thailand)
Dr. U.I. Dissanayake (Ph.D., Sheffield, UK)
Dr. K.P.P. Pathirana (PARI, Japan)
Dr. I.M.S. Sathyaprasad (D.Eng., Yokohama, Japan)

DEPARTMENT OF ELECTRICAL & ELECTRONIC ENGINEERING

Prof. J.A. Gunawardena (Ph.D., Cambridge, UK)
Prof. W.P. Jayasekara (Ph.D., U of London, UK)
Prof. E.M.N. Ekanayake (Ph.D., McMaster, Canada)
Dr. V. Muthukkumarasamy (Ph.D., Cambridge, UK)
Dr. K.B.N. Ratnayake (Ph.D., RPI, USA)
Dr. K.M. Liyanage (DEng., U of Tokyo, Japan)
Dr. J.B. Ekanayake (

DEPARTMENT OF MECHANICAL ENGINEERING

Prof. S. Mahalingam (DSc, Sheffield, Ph.D., U of London, UK)
Mr. S.K. Seneviratne (M.Sc., U of Leeds, UK)
Dr. K.E.D. Sumanasiri
Dr. M.B. Kahawatte (Dr.Ing, U of Frieberg, Germany)

Dr. B.R.K. Obeysekera (Ph.D., Moscow State University, USSR)

DEPARTMENT OF ENGINEERING MATHEMATICS

Dr. S.B. Siyambalapitiya (Ph.D., U of New Castle, NSW, Australia)
Prof. T.D.M.A. Samuel (Ph.D., Manchester, UK)
Dr. K.S. Walgama (Ph.D., U of Lulea, Sweden)
Dr. Mrs. K. Perera (Ph.D., State Univ. of NY, USA)
Dr.H.S. Balasuriya (Ph.D.)

DEPARTMENT OF CHEMICAL ENGINEERING

Prof. W.J.N. Fernando (Ph.D., U of London, UK)
Dr. R. Shanthini (Ph.D., U of Lulea, Sweden)

DEPARTMENT OF PRODUCTION ENGINEERING

Prof. S. Ranatunga (Ph.D., U of Birmingham, UK)
Dr. S.D. Pathirana (DEng., U of Tokyo, Japan)
Dr. D.S. Devapriya (Ph.D., U of Grenoble, France)

NAME	TITLE	DEPARTMENT
Mr. J.H.J. JAYAMAHA	Director of Japan Department	Ministry of finance and Planning, Dept. of External Resource
Mr. S. TILAKARATNA	Chairman	University Grant Commission
Mr. ANDREW DE SILVA	Secretary	Ministry of Education and Higher Education
Mr. N. U. YASAPALA	Additional Secretary	-ditto-
Mr. PREMASIRI WELIWITA	Director, Non-formal Education	-ditto-
Dr. L. GUNAWARDENA	Vice Chancellor	University of Peradeniya
Dr. L.L. RATNAYAKE	Dean, Faculty of Engg.	University of Moratuwa
Mr. TADASHI KONDO	Resident Representative	Asian Development Bank, Sri Lanka Resident Mission
Ms. SRUYANI HULUGALLE	Industrial Economist	The World Bank, Sri Lanka Office
M.D.. KANAME KANAI	First Secretary	Embassy of Japan, Sri Lanka
Mr. YOSHIAKI KANO	Resident Representative	JICA Sri Lanka Office
Ms. JUNKO FUJIWARA	Assistant Resident Representative	-ditto-

4. Minutes of Discussion

Minutes of Discussions

Basic Design Study on the Project for the Improvement of Educational Equipment for the Faculty of Engineering, University of Peradeniya in the Democratic Socialist Republic of Sri Lanka

In response to a request from the Government of the Democratic Socialist Republic of Sri Lanka, the Government of Japan has decided to conduct the Basic Design Study on the Project for the Improvement of Educational Equipment for the Faculty of Engineering, University of Peradeniya (hereinafter referred to as "the Project"), and entrusted the study to Japan International Cooperation Agency (JICA).

JICA sent to Sri Lanka a study team, which is headed by Mr. Akira HARA, Development Specialist, JICA, and is scheduled to stay in the country from January 7th to 28th, 1998.

The team has held discussions with the officials concerned of the Government of Sri Lanka and conducted a field survey at the study area.

As a result of discussions and field survey, both parties have confirmed the main items described on the attached sheets. The Team will proceed to further works and prepare the Basic Design Report.

Colombo, 15th January, 1998

Mr. Akira HARA
Leader
Basic Design Study Team
Japan International Cooperation Agency

Mr. Andrew de Silva
Secretary
Ministry of Education and Higher Education

Witness of:

Prof. S. TILAKARATNA
Chairman
University Grants Commission

Mr. J. H. J. JAYAMAHA
Director of Japan Department
Department of External Resource
Ministry of Finance and Planning

Prof. R J K S K Ranatunga
Dean/Engineer
for Vice Chancellor
University of Peradeniya.

ATTACHMENT

1. Objective of the Project

The objective of the Project is to improve the quality of engineering education in Sri Lanka through helping the Faculty of Engineering, University of Peradeniya to provide its students better educational environment.

2. Project Site

The Project site is located in the Faculty of Engineering, University of Peradeniya in the city of Kandy

3. Responsible and Executing Organisation

The responsible organisation for the Project is Ministry of Education and Higher Education, and its executing organisation is University of Peradeniya.

4. Items Requested by the Government of Sri Lanka

After discussions with the Basic Design Study team, the Sri Lanka side requested items listed in Annex-1.

Nevertheless, the Government of Sri Lanka understands that final components of the Project will be decided in Japan after further studies based on the field survey.

5. Criteria for Equipment Selection and Design

The requested equipment will be given the priority in accordance with the criteria attached as Annex-2, which are approved by both parties.

Nevertheless, the Government of Sri Lanka understands that final decision in the selection and design of the equipment of the Project will be made in Japan after further studies based on the field survey.

6. Japan's Grant Aid System

1) The Government of Sri Lanka has understood the system of Japanese Grant Aid explained by the Team, described in Annex-3.
2) The Government of Sri Lanka will take the necessary measures described in Annex-4 for smooth implementation of the Project on condition that Grant Aid assistance by the Government of Japan is extended to the Project.

7. Schedule of the Study

1) The consultant team will continue further studies in Sri Lanka until 26th January 1998.
2) Based on the Minutes of Discussions and technical examination of the study results, JICA will complete the final report and send it to the Government of Sri Lanka around April 1998.

Item		Description
1. DEAN'S OFFICE		
	1	Color video projector system
	2	180" spring roll type screen
	3	Beta or VHS recorder with editing facilities
	4	VTR system
	5	Audio system
	6	Accessories for 35mm camera
	7	Digital camera
	8	Multimedia projector, portable
	9	Visual system presenter
	10	LCD projection panel
	11	Slide projector
	12	Slide viewer
	13	Color slide maker
	14	Cassette tape recorder
	15	Power amplifier
	16	Speaker system
	17	Dynamic microphone
	18	Floor stand for microphone
	19	Wireless microphone
	20	Clip-on microphone
	21	Laser pointer
	22	Audio and video facilities for a conference room
2. CIVIL ENGINEERING		
	1	Scanning electron microscope
	2	X-radiographic equipment
	3	Micro hardness tester
	4	Rockwell hardness tester
	5	Brinell hardness tester
	6	Vickers hardness tester
	7	High temperature furnace
	8	Metallurgical microscope without camera arrangements
	9	Metallurgical microscope with camera arrangements
	10	Universal testing machine
	11	Sieve shaker
	12	Large cohesionmeter, double cylinder type
	13	Thermostatic water circulation set
	14	Strain gauge measuring system
	15	Data logger to accept output from strain gauges and civil transducers
	16	Scanner
	17	Portable concrete core cutting machine
	18	Two dimensional wave generator
	19	Free and forced vortex apparatus
	20	Spectro photometer
	21	River water quality test kit
	22	Pump performance test bench
	23	Total water hardness kit
	24	Electronic distance meter (1km)
	25	6" Theodolite
	26	Color GPS video plotter
	27	Echo sounder
	28	Total station
	29	Traversing target set

Item		Description
	30	Tribrach
	31	20" Digital theodolite
	32	5" Electronic digital theodolite
	33	Heavy duty network printer
	34	Drum plotter
	35	Inkjet printer
	36	Portable CD drive
	37	Advanced workstation
	38	Personal computer, desktop
	39	Power auger
	40	Dutch cone penetrometer
	41	Three-sensor cone penetrometer
	42	Table-top rock lathe
	(43)	Data acquisition and control system for large scale structural testing facility
	44	Shaking table for dynamic studies in structures - computer controlled
	45	Industrial grade video camera system capable of high frame rate
3. MECHANICAL ENGINEERING		
	1	Thermal conductivity measuring apparatus
	2	Forced convection heat transfer apparatus
	3	Air compressor test unit
	4	Data acquisition terminal
	5	Air-cooled eddy-current electro brake dynamometer
	6	Torque transducer
	7	Thermocouple
	8	Magnetic drive pump
	9	Water flow meter
	10	Multi hygrometer
	11	Thermal conductivity meter
	12	Pressure measurement bench
	13	Refrigeration/air conditioning training equipment
	14	Potentionstat galvanostat
	15	Industrial microscope
	16	Digital multimeter
	17	Exhaust analyzer
	18	Viscometer
	19	Differential pressure transducer
	20	Pressure transducer
	21	Miniature Acceleration transducer
	22	Thermostat set
	23	Thermo couple wire
	24	Portable overhead projector
	25	Arc welder
	26	Electronics tool kit
	27	Industrial rotor balancing machine
	28	Gas turbine test bed
4.PRODUCTION ENGINEERING		
	1	Educational robot system complete with conveyor loop
	2	PLC
	3	Mini N/C milling machine, mini N/C lathe machine with CAM program link software
	4	PLC net
	5	Ethernet

Item		Description
	6	CNC machining center
	7	Numericelly controlled turning center
	8	Surface roughness measuring machine, analyzer, printer & recorder
	9	Industrial robot with controller and computer, gripper
	10	Piezo-electric crystal dynamometer, amplifier and
	11	Portable FFT analyzer
	12	Motion control hardware
	13	Computer hardware
	14	Programmable logic controller
	15	Laser Interferometer
	16	Bore scope with optical fiber
	17	Coordinate measuring machine with both joystick motor driven and CNC control
	18	Small size press
	19	Instrumentation lab equipment
	20	NC punching machine with 10 tools
	21	Furnace for heat treatment of cutting tools
	22	Pneumatic system
	23	Hydraulic system
5. ENGINEERING MATHEMATICS		
	1	Portable overhead projection and accessories
	2	Computer image projection system
	3	Regulated DC power supply
	4	Audio recording and play back facility for small groups of students
6. COMPUTER SCIENCES		
	1	Micro computer trainor
	2	Input/output board
	3	A/D-D/A converter assembly
	4	Computer element experimental equipment
	5	Computer basic experimental equipment
	6	A/D conversion experimental equipment
	7	D/A conversion experimental equipment
	8	D/A converter trainer
	9	A/D converter trainer
	10	Logic tester
	11	Logic analyzer
	12	Regulated DC power supply
	13	Analog multitester
7. ELECTRICL AND ELECTRONIC ENGINEERING		
	1	D.C. Micro meter with knife-edge pointer and mirror scale, 30/100/300/1000/3000A
	2	D.C. Millimeter with knife-edge pointer and mirror scale, 10/30/100/300/1000mA
	3	D.C. ammeter
	4	D.C. voltmeter
	5	A.C. voltmeter (portable standard)
	6	Rheostats
	7	Tachometer (handheld type)
	8	Stop watch
	9	Waveform analyzer 30 Hz-16 kHz
	10	Transistor curve tracer
	11	Logic circuit experimental equipment
	12	Computer experimental equipment

Item	Description
13	Computer basic experimental equipment
14	AD conversion experimental equipment
15	DA conversion experimental equipment
16	Circuit testers (multimeters)
17	Pulse generator
18	OP-amp tester
19	Function generator
20	Standard signal generator
21	RC oscillator
22	D.C. tracking power supply
23	Analogue oscilloscopes
24	Analogue storage oscilloscope·
25	Digital storage oscilloscope 100 MHz
26	Decade resistance box
27	Decede capacitor box
28	Decade inductor box
29	Standard variable inductor
30	Variable filter box, band pass, low pass & high pass.
31	Digital multimeter
32	Transistor checker
33	Impedance bridge
34	Digital IC tester
35	Digital CR meter
36	Synthesized signal generator
37	Frequency counter
38	Waveform monitor
39	X - Y recorder
40	Plotter to interface with storage oscilloscope
41	Field strength meter (25 Hz to 1700 MHz)
42	Spectrum analyzer
43	Optical fibre communication teaching/experimental kit
44	Noise figure measurement systems
45	Network analyzer
46	White noise generator
47	Antenna modeling/testing system 1 GHz range
48	VSWR meter upto 1GHz
49	Klystron 2 GHz low power
50	Error rate measurement system for digital communication
51	Digital communication teaching kit
52	Antenna demonstration kit
53	PAL color pattern generator
54	RADAR demonstration/experimental kit
55	Video camera with interfacing faculty to personal computer
56	Portable measuring instruments
57	Variable wire wound resistor
58	Variable inductor and capacitor
59	Protective relay of various type
60	Electro-magnetic type recorder
61	PC based data logging
62	Insulation tester
63	Stroboscope
64	AC single-phase capacitor motor
65	DC series-motor
66	Knife switch
67	Portable single phase lower power(5-25A)

Item	Description
68	Portable single phase wattmeter
69	Molded case circuit breaker
70	Earth tester
71	DC voltage current standard
72	AC voltage current standard
73	Microcomputer Training system
74	Color TV trainer
75	Control trainer
76	Telecommunication training system
77	Logic analyzer
78	Micro processor development system
79	Digital signal processing hardware development system
80	Digital audio recording/processing system
81	Archival system
82	DC speed control system
83	DC position control system
84	Low frequency signal generator
8. LANGUAGE LAB	
1	Twin booth set
2	Student cassette deck
3	Head set with microphone and cable
4	Bulk eraser for cassette
5	Speaker
6	Open red muster
7	Microphone
8	Master cassette recorder
9	Head set with microphone
10	Remote control unit
11	Language Lab control console
12	Audio stereo amplifier
13	Color video monitor
14	Duplicating machine
15	Overhead projector
16	Screen 1500 x 1500 mm
17	Electronic typewriter
18	Cassette recorder
9. CHEMICAL ENGINEERING	
1	Ultra high temperature muffle furnace
2	Digital refractionmeter
3	CHN coder
4	Micro calorimeter
5	Total organic carbon analyzer
6	Automatic Sox Nox analyzer for stack gas
7	Automatic non-methane hydrocarbon analyzer
8	Stereo microscope
9	Polarimeter
10	Ultra homomixer
11	Electric oven
12	Autoclave
13	Continuous flow centrifuge
14	Pressure homogenizer
15	Atomic absorption spectrophotometer
10. COMPUTING CENTER	
1	Uninterrupted power supply
2	Color laser printer

ANNEX-1 ITEMS REQUESTED BY SRI LANKA SIDE

Item	Description
3	Heavy duty line printers
4	Color scanners
5	Plotters
6	Laptop computer
7	Personal computer, desktop

ANNEX-2 CRITERIA FOR EQUIPMENT SELECTION AND DESIGN

1. Criteria for priority

Criteria to be used for the selection of equipment are as follows;

1) New equipment which cannot be provided by own budget and which is indispensable to education for undergraduate students.

2) Addition to the existing equipment which is seriously shortage for teaching the current number of students.

3) Replacement for the existing equipment which is outdated or deteriorated to meet the basic functions or needs of minimum educational standard.

4) New equipment which is newly required to meet the needs aroused from curriculum revision or course changes .

2. Criteria for elimination

Those which conform to the criteria listed below will be eliminated from the component

1) Equipment which needs high level skill, many trained staff or expensive cost for proper use and maintenance.

2) Equipment which needs reconstruction and extension of the building when installation.

3) Equipment whose spare-parts cannot be procured easily in Sri Lanka.

4) Equipment whose functions are too sophisticated or unmatched to the needs of industries in Sri Lanka.

5) Equipment which is likely to be used only by the specific person and groups.

6) Equipment which is categorized under the consumption articles.

7) Equipment whose indispensability cannot be proved by curriculum or syllabus.

8) Equipment which is made or sold by the specific company.

9) Equipment which is scheduled to be improved by other aid agencies.

ANNEX-3 JAPAN'S GRANT AID SCHEME

1. Grant Aid Procedures

1) Japan's Grant Aid Program is executed through the following procedures.

- Application
  Request made by the recipient country
- Study
  Basic Design Study conducted by JICA
- Appraisal & Approval
  Appraisal by the Government of Japan and Approval by the Cabinet
- Determination of Implementation
  The Notes exchanged between the Governments of Japan and the recipient country

2) Firstly, the application or request for a Grant Aid project submitted by a recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to determine whether or not it is eligible for Grant Aid. If the request is deemed appropriate, the Government of Japan assigns JICA (Japan International Cooperation Agency) to conduct a study on the request.
Secondly, JICA conducts the study (Basic Design Study), using (a) Japanese consulting firm(s).
Thirdly, the Government of Japan appraises the project to see whether or not it is suitable for Japan's Grant Aid Program, based on the Basic Design Study report prepared by JICA, and the results are then submitted to the Cabinet for approval.
Fourth, the project, once approved by the Cabinet, becomes official with the Exchange of Notes signed by the Governments of Japan and the recipient country.
Finally, for the smooth implementation of the project, JICA assists the recipient country in such matters as preparing tenders, contracts and so on.

2. Basic Design Study

1) Contents of the study
The purpose of the Basic Design Study (hereafter referred to as "the Study"), conducted by JICA on a requested project (hereafter referred to as "the Project") is to provide basic document necessary for the appraisal of the Project by the Japanese Government. The contents of the Study are as follows:

a) Confirmation of the background, objectives, and benefits of the requested Project and also institutional capacity of agencies concerned of the recipient country necessary for the Project's implementation.
b) Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from the technical, social and economic point of view.
c) Confirmation of items agreed on by both parties concerning the basic concept of the Project.
d) Preparation of a basic design of the Project
e) Estimation of costs of the Project.

The contents of the original request are not necessarily approved in their initial form as the contents of the Grant Aid project. The Basic Design of the Project is confirmed considering the guidelines of Japan's Grant Aid Scheme.

The Government of Japan requests the Government of the recipient country to take whatever measures are necessary to ensure its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization in the recipient country actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations the recipient country through the Minutes of Discussions.

2) Selection of Consultants

For smooth implementation of the Study, JICA uses (a) registered consultant firm(s). JICA select (a) firm(s) based on proposals submitted by interested firms. The firm(s) selected carry(ies) out a Basic Design study and write9s) a report, based upon terms of reference set by JICA.

The consulting firm(s)used for the Study is(are) recommended by JICA to the recipient country to also work on the Project's implementation after the Exchange of Notes, in order to maintain technical consistency.

3. Japan's Grant Aid Scheme

1) What is Grant Aid?

The Grant Aid Program provides a recipient country with non-reimbursable funds needed to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. Grant Aid is not supplied through the donation of materials as such.

2) Exchange of Notes (E/N)

Japan's Grant Aid is extended in accordance with the Notes exchanged by the two Governments concerned, in which the objectives of the Project, period of execution, conditions and amount of the Grant Aid, etc., are confirmed.

3) The period of the Grant Aid means the one fiscal year which the Cabinet approves the Project for. Within the fiscal year, all procedures such as exchanging of Notes, concluding contracts with (a) consultant firm(s) and (a) contractor(s) and final payment to them must be completed.

However in case of delays in delivery, installation or construction due to unforeseen factors such as weather, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two Governments.

4) Under the Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased.

When the two Governments deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country.

However the prime contractors, namely, consulting constructing and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

5) Necessity of "Verification"

The Government of recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. This "Verification" is deemed necessary to secure accountability to Japanese taxpayers.

6) Undertakings required of the Government of the Recipient Country

In the implementation of the Grant Aid project, the recipient country is required to undertake such necessary measures as the following:

a) To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the construction.

b) To provide facilities for the distribution of electricity, water supply and drainage and other incidental facilities in and around the sites.

c) To secure buildings prior to the procurement in case the installation of the equipment.

d) To ensure all the expenses and prompt execution for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid.

e) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified Contracts.

f) To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the Verified contracts, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.

7) "Proper Use"

The recipient country is required to maintain and use the facilities constructed and the equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

8)Re-export

The products purchased under the Grant Aid should not be re-exported from the recipient country.

9) Banking Arrangements (B/A)

a) The Government of the recipient country or its designated authority shall open an account in the name of the Government of the recipient country in an authorized foreign exchange bank in Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.

b) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an authorization to pay issued by the Government of the recipient country or its designated authority.

ANNEX-4 NECESSARY MEASURES TO BE TAKEN BY SRI LANKA SIDE

Following necessary measures should be taken by the Sri Lanka side on condition that the Grant Aid by the Government of Japan is extended to the Project:

1. To provide data and information necessary for the Project,

2. To complete the relocation of the existing equipment, facilities and civil works required prior to the installation of the equipment and settings, if necessary,

3. To provide facilities for distribution of electricity, water supply, telephone, drainage, sewage and other incidental items required for the Project,

4. To ensure enough budget for operation and maintenance cost and staff timely by the Ministry of Education and Higher Education,

5. To allocate enough number of teaching staff to maximize educational effects of the equipment by the University of Peradeniya under the supervision of Ministry of Education and Higher Education,

6. To procure required parts for maintenance timely and sufficiently by the University of Peradeniya under the supervision of Ministry of Education and Higher Education,

7. To bear commissions to the Japanese foreign exchange bank for its banking services based upon the Banking Arrangement, namely the advising commission of the "Authorization to Pay" and payment commission,

8. To exempt Japanese juridical and physical nationals engaged in the Project from customs duties, internal taxes and other fiscal levies which may be imposed in Sri Lanka,

9. To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into Sri Lanka and stay therein for the performance of their work in accordance with the relevant laws and regulations of the Democratic Socialist Republic of Sri Lanka,

10. To provide necessary permissions, licenses and other authorizations for implementing the Project, if necessary,

11. To maintain and use properly and effectively the equipment provided under the Project in responsibility of the the University of Peradeniya under supervision of Ministry of Education and Higher Education,

12. To make effort to provide and keep access and good educational environment for students those who will contribute to the development of Sri Lanka,

13. To bear all the expenses, other than those to be borne by the Japan's Grant Aid within the scope of the Project by the Government of Sri Lanka.

5. Cost Estimation Borne by the Recipient Country

The estimated costs borne by the Faculty of Engineering after the improvement of new equipment under the Project are as follows:

Estimate condition: 1 US$ = SL Rs 61.- , 1 US$ = 124.0. J¥

Maintenance and procurement of consumable and spare parts:

- Procurement of consumable and spare parts: 640,000 J¥ (after the second year, 0 J¥ for the first year)
- Maintenance cost: 840,000.- (410,000.- in the first year)