

## **CHAPTER 4 BASIC DESIGN OF THE PROJECT**



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### 4.1 Selection of Equipment

With the examination of necessary equipment for each department, final selection of the equipment and preparation of the basic specifications are done considering the basic course as below.

(1) Basic design of the specifications corresponding to the curricula and the experiments of each department

- 1) Coherence between the contents of education or research called for by the curricula and syllabi and the composition and the specifications of the requested equipment
- 2) Quantity of the equipment suitable to the contents of education or research, the number of students, the number of rooms and the number of existing items of equipment
- 3) Coherent selection of each equipment, and consistency of the specifications with each other

(2) Equipment compatible with the existing equipment and utilities

- 1) Selection of the requested equipment to remedy the problems of the existing equipment
- 2) Conformity to the capacity of existing supporting facilities for electricity, water, steam and drainage

(3) Ease of maintenance and technology transfer

- 1) Relevant consideration about accessories, spare parts and tools judging from the specifications of each equipment
- 2) Consideration about installation of the necessary equipment, for example, which ensures uninterruptible power supply system in case of power failure
- 3) Consideration about completion of the instruction manuals and the operation manuals for acquirement and operation of the equipment
- 4) Consideration about completion of the manuals for equipment trouble.

As a result of the above examination, 383 pieces of equipment was selected. Table 4.4.2 "List of Equipment" with basic specifications of each equipment is attached at the end of Chapter 4.

Table 4.1.1 Number of Selected Equipment

Department	Number of Items
Electrical Engineering	43
Electronic & Telecommunication Engineering	82
Computer Science & Engineering	60
Chemical Engineering	27
(Cheical Engineering Division)	(16)
(Polymer Technology Division)	(11)
Materials Engineering	7
Mathematics	1
Textile Technology	99
(Cheical Processing and Testing Lab.)	(29)
(Clothing Lab./Sewing Machines with Special Features)	(46)
(Spinning Lab.)	(13)
(Knitting Lab.)	(4)
(Weaving Lab.)	(7)
Common Facility	64
(Engineering Library)	(16)
(Physical Education)	(5)
(Language Lab.)	(42)
(Central Teaching Support)	(1)
<b>Total</b>	<b>383</b>

## 4.2 Basic Specifications on Equipment

The existing equipment of the University has been provided from various countries and the standards vary. Codes and standards applied to the equipment of the Project will be in principle of Japanese (JIS:Japan Industrial Standards, JEC:Standard of the Japanese Electrotechnical Committee, JEM: The Standard of Japan Electrical Manufacturer's Association, etc.). Nominal voltages will be single phase 230V, 50Hz or three-phase 400V, 50Hz. Electrical equipment rated on 230V should have a plug socket of British Standard in order to meet the requirement of the receptacles used in the country. The present supply conditions of experimental water are 10 meter's head in supply pressure and 30 to 35 degree centigrade in temperature.

## 4.3 Equipment Layout Plan

### 4.3.1 Project Site

The University of Moratuwa is located at Katubedda within the Urban Council Limits of Moratuwa, 18km from Colombo. The neighborhood is a quiet rural district and the east end of the Campus is adjacent to the Bolgoda Lake. The University occupies a land area of 57 acres and the number of total students of the two faculties is about 1,700. Figure 4.3.1 shows the layout of the University. Textile Technology Department's new building is under construction now on the plot indicated by shadow in the figure. In this new building, extension of the Department of Textile Technology is under consideration, and there is no space problem about the installation and utilities.

### 4.3.2 Equipment Layout Plan

Each laboratory was inspected for identifying problems associated with bringing equipment into the laboratories and also with installation.

(1) Access

The university site is generously laid out and equipment can easily be introduced into each laboratory via service roads in the University. Forklift trucks or light trucks, etc. can approach from anywhere. Actually, in the Department of Mechanical Engineering and the Department of Mining and Minerals Engineering, several pieces of equipment far larger than the largest requested equipment are installed. At implementation stage, all pieces of equipment supplied under the Project will be transported from the intermediate warehouse to the University of Moratuwa, thus necessitating timely delivery of the equipment in conformity with the installation schedule.

(2) Plot Plan of the Equipment

Each piece of equipment will be arranged in each laboratory suitable for the purpose of use. In Table 4.3.1 name and outline of laboratories and the equipment to be installed are shown. And layout of each laboratory in each department is shown in Figure 4.3.2. Each laboratory has enough space for the installation. In each laboratory of the Department of Electrical Engineering, Electronic & Telecommunication Engineering, Chemical Engineering and Materials Engineering, the number of the existing equipment is not many; the installation work will be carried out smoothly without removing the existing equipment. As for Department of Textile Technology, new building is under construction now, and as for Department of Computer Science & Engineering, new rooms will be added. Both departments will have sufficient installation space.

The Engineering Library requests book stock shelvings, compact mobile shelving systems, microfilm readers for reference, etc. The space of the library can be used more effectively with them. Installation space for physical education is enough, and at the Language Laboratory new rooms will be assigned for installation of an LL system.

(3) Condition of Installation

There are air-conditioned rooms and non air-conditioned rooms depending upon the required services. An air conditioning system is necessary for such equipment as computers, electron microscope, etc. The manufacturer should present loading data for heavy equipment which requires a base.

4.3.3 Supply of Utility

(1) Water

The University of Moratuwa has three kinds of water: city water, well water and river water. Water is pumped up to the head tanks on the rooftop of the building (about 10m high above the ground level). Care must be exercised to maintain proper water pressure and temperature. Water coolers are to be considered.

(2) Electricity

The University of Moratuwa receives electricity from a transmission line of a commercial power company at 33KV, 50Hz. Transmission power capacity is sufficient from the viewpoint of power consumption counting the increase due to the installation of new equipment that is estimated to be from 150 KVA to 200 KVA. There are three substations in the Campus. Ratings (capacity and voltage) of the three transformers and present maximum power consumption are shown as follows:

	<u>Maximum Consumption</u>
1) No.1 Transformer (400KVA, 33KV-400/230V) :	230KVA
For building of the Dep't of Electrical Engineering, Electronic & Telecommunication, Computer Science & Engineering, etc.	

- 2) No.2 Transformer (400KVA, 33KV-400/230V) : 30KVA  
 For building of the Department of Civil  
 Engineering, Textile Technology, etc.
- 3) No.3 Transformer (150KVA, 33KV-400/230V) : 10KVA  
 For student hostel

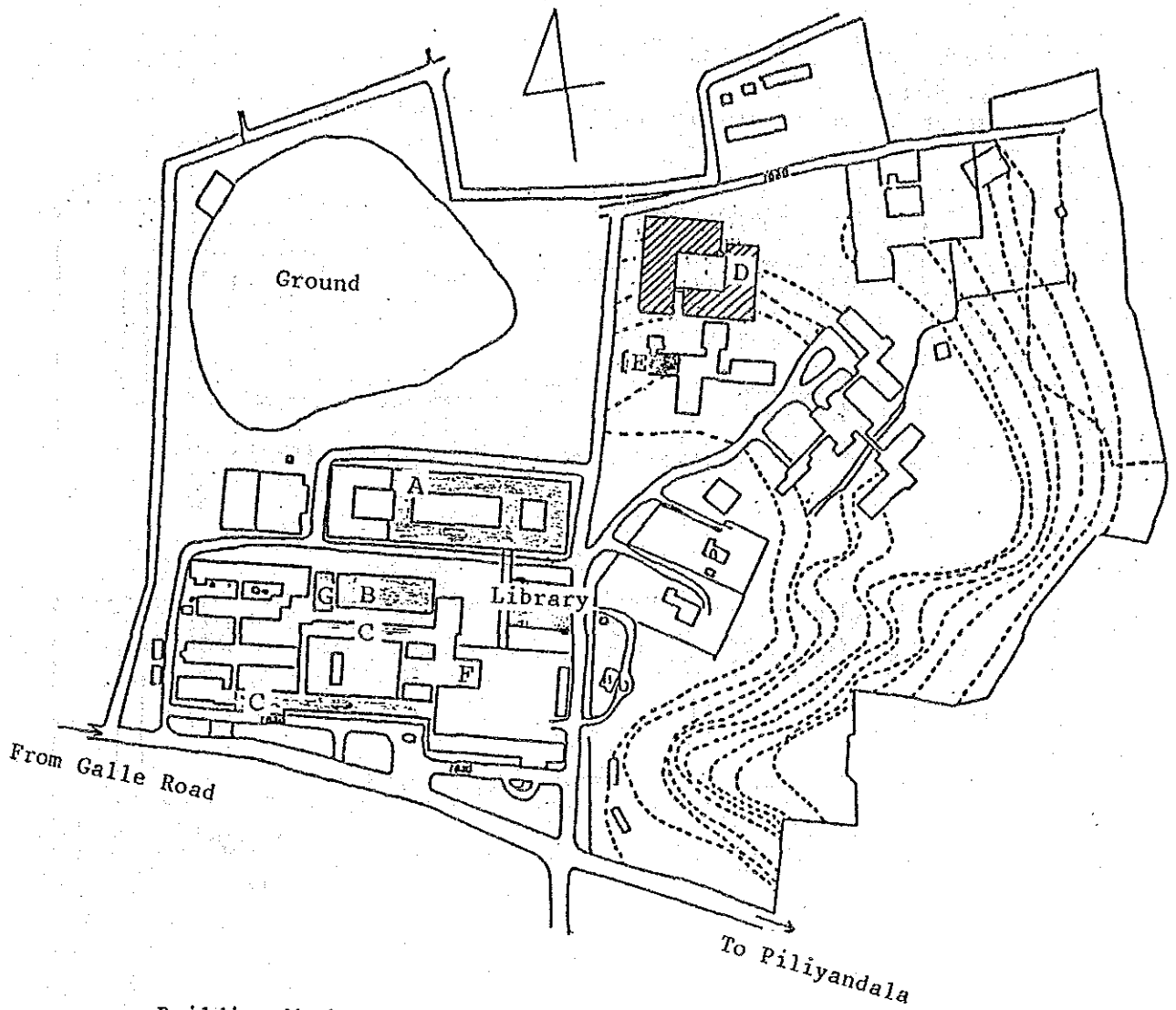
Voltage fluctuation is considerable from time to time in the building for the Department of Electrical Engineering, Electronic & Telecommunication Engineering and Computer Science & Engineering since No.1 Transformer capacity is not enough (consumption of 60%) and main cable size distributed into the building is small. Therefore, under such a condition the electronics equipment and computers cannot function properly because of excessive voltage drop. Any increase in power consumption of the No.1 transformer would aggravate the voltage fluctuation, while installation of large air-conditioners is planned for the computer laboratories. Under such a condition the University has decided to replace the No.1 transformer and main cable in parallel with this Project. The problem will be solved after the replacement.

There are two stand-by generating systems each 250KVA in the Campus as back-up power source. These generators have enough capacity to supply power to essential loads such as computers in case of failure of commercial power line.

#### 4.4 Technical Training with Installation of Equipment

Some of the equipment requested is large, highly sophisticated or part of an integrated system. These require supervisory work for installation and commissioning. For this equipment, Japanese supervisors will be sent to the site to perform supervisory works. Table 4.4.1 shows the main equipment requiring supervisory work for installation.





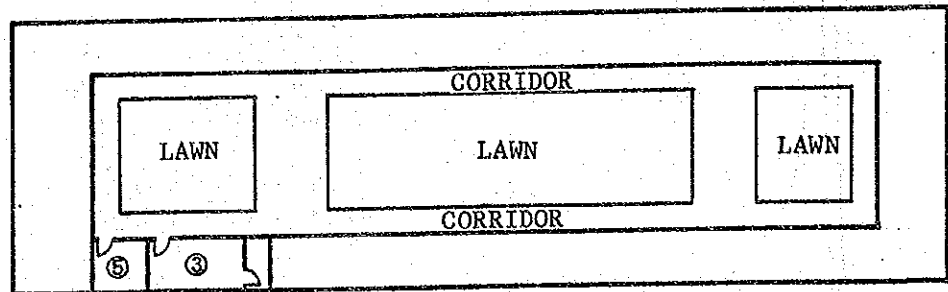
<u>Building Mark</u>	<u>Department</u>
A	Electrical Engineering Electronic & Telecommunication Engineering Computer Science & Engineering Mathematics
B	Chemical Engineering Materials Engineering
C, G	Chemical Engineering Physics Laboratory
D	Textile Technology (Under Construction)
E	Language Laboratory
F	Gymnasium

Figure 4.3.1 Layout of the University of Moratuwa

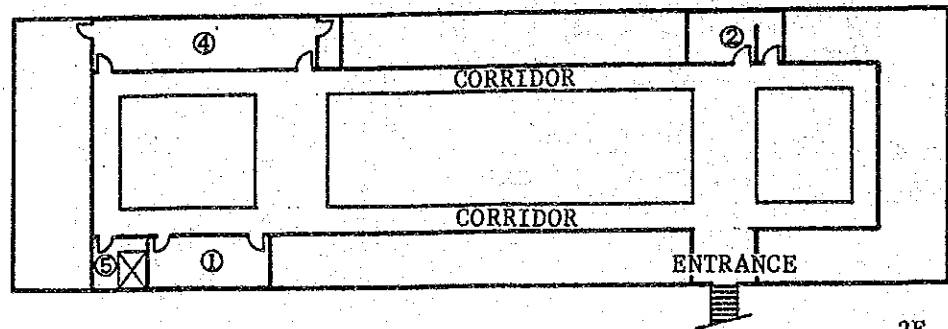
Department: Electrical Engineering

(Building : A \*)

\* Letter indicates the buildings in Figure 4.3.1



1F



2F

Room No.	Laboratory Name
①	Electrical Measurement Lab.
②	Electrical Wiring Lab.
③	Electrical Power System Lab.
④	Electrical Machines Lab.
⑤	High Voltage Lab.

0 20 40 m

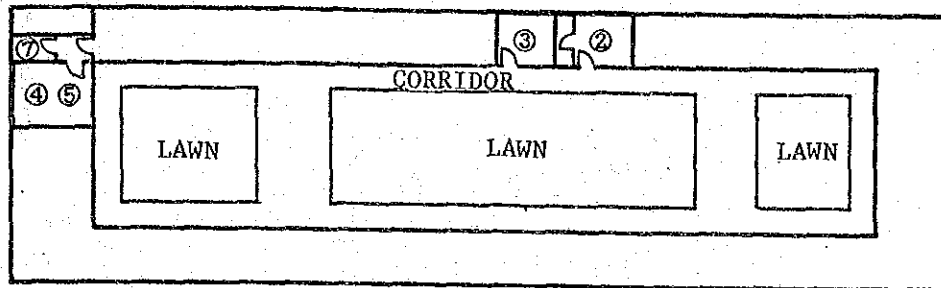


Figure 4.3.2 Layout Plan of Laboratories (1)

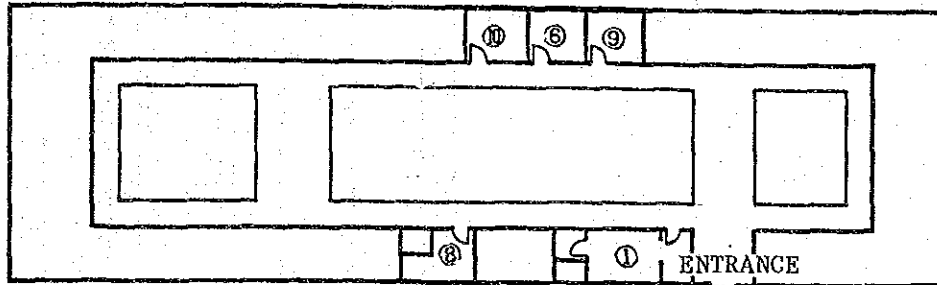
Department: Electronic & Telecommunication Engineering

(Building : A)

\* Letter indicates the buildings in Figure 4.3.1



3F



2F

0 20 40 m



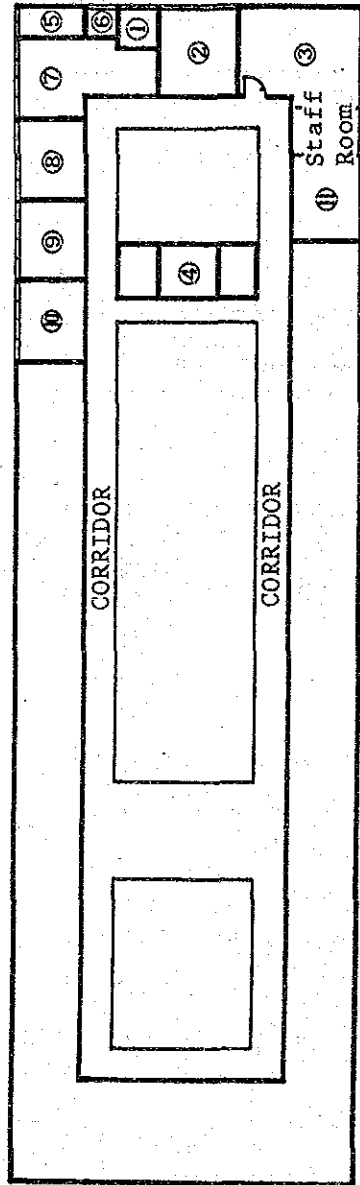
Room No.	Laboratory Name	Room No.	Laboratory Name
①	Computer System Lab.	⑥	Project Lab.
②	Work Shop	⑦	Opto Electronics Lab.
③	Microwave Lab.	⑧	Electronic System Lab.
④	Telecommunication Lab.	⑨	Digital Electronic Lab.
⑤	T. V. Lab.	⑩	Industrial Electronic Lab.

Figure 4.3.2 Layout Plan of Laboratories (2)

Department: Computer Science & Engineering

(Building : A)

\* Letter indicates the buildings in Figure 4.3.1



Room No.	Laboratory Name	Room No.	Laboratory Name
①	CPU Room	⑦	Terminal Room 01
②	Microcomputer Lab. 01	⑧	Data Communication Lab.
③	Microcomputer Lab. 02	⑨	Microcomputer Systems Design Lab.
④	Maintenance Centre	⑩	Digital Instrumentation Lab.
⑤	New CPU Room	⑪	Terminal Room 02
⑥	UPS Room		

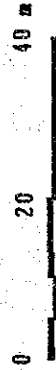
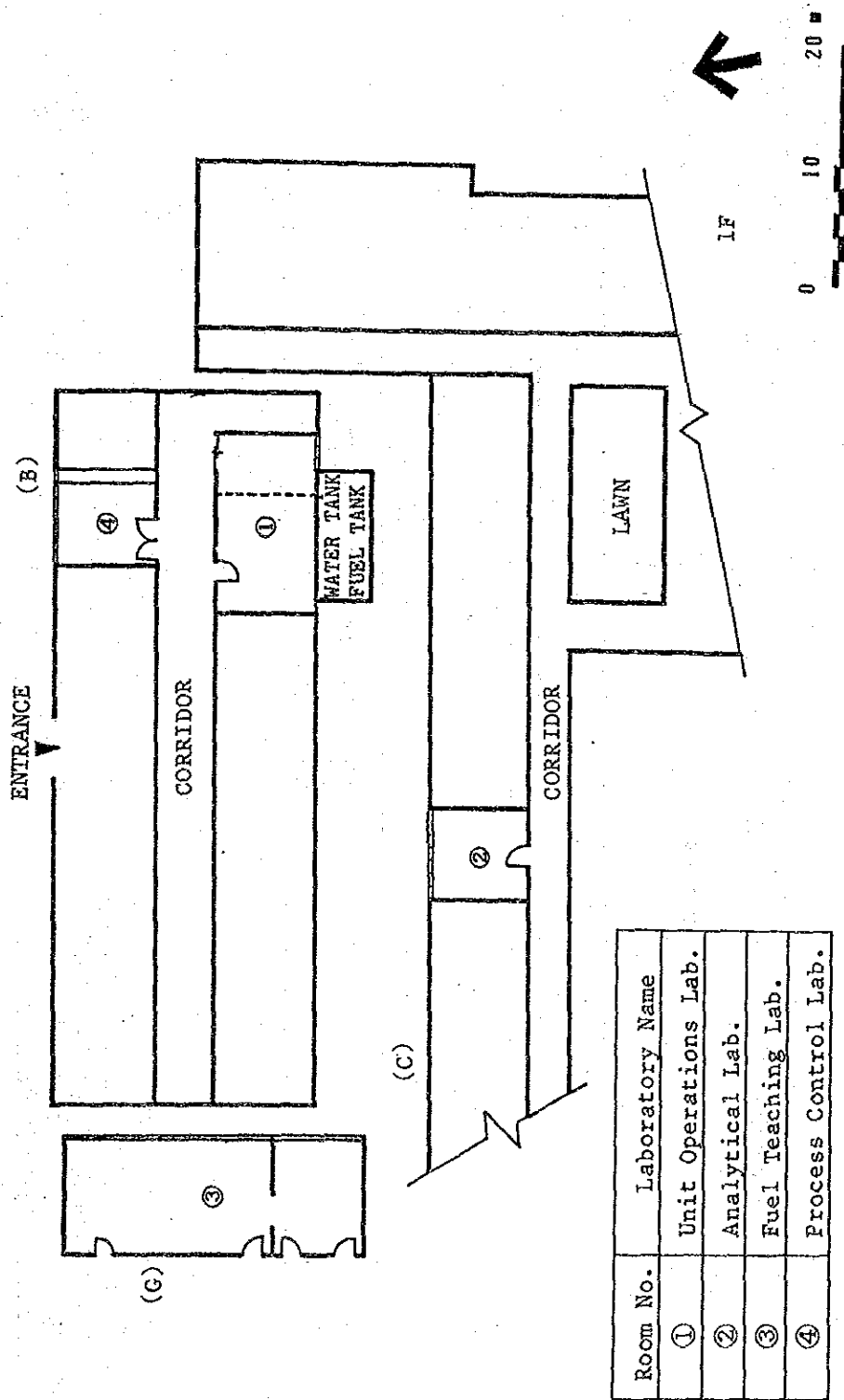


Figure 4.3.2 Layout Plan of Laboratories (3)

Department: Chemical Engineering (Chemical Engineering Div.)

(Building : B, C, G)

\* Letter indicates the buildings in Figure 4.3.1



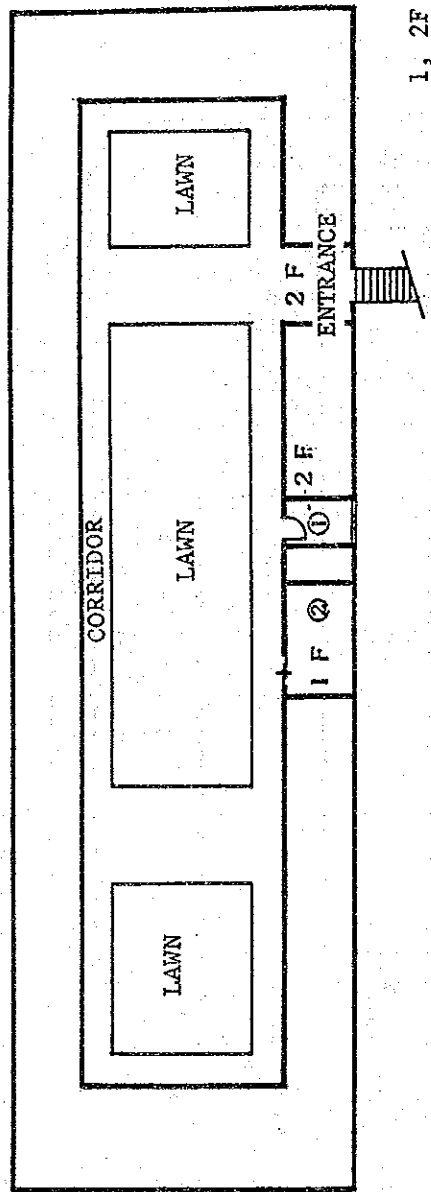
Room No.	Laboratory Name
①	Unit Operations Lab.
②	Analytical Lab.
③	Fuel Teaching Lab.
④	Process Control Lab.

Figure 4.3.2 Layout Plan of Laboratories (4)

Department: Chemical Engineering (Polymer Technology Div.)

(Building : A)

\* Letter indicates the buildings in Figure 4.3.1



Room No.	Laboratory Name
①	Processability Lab.
②	Processing Lab.

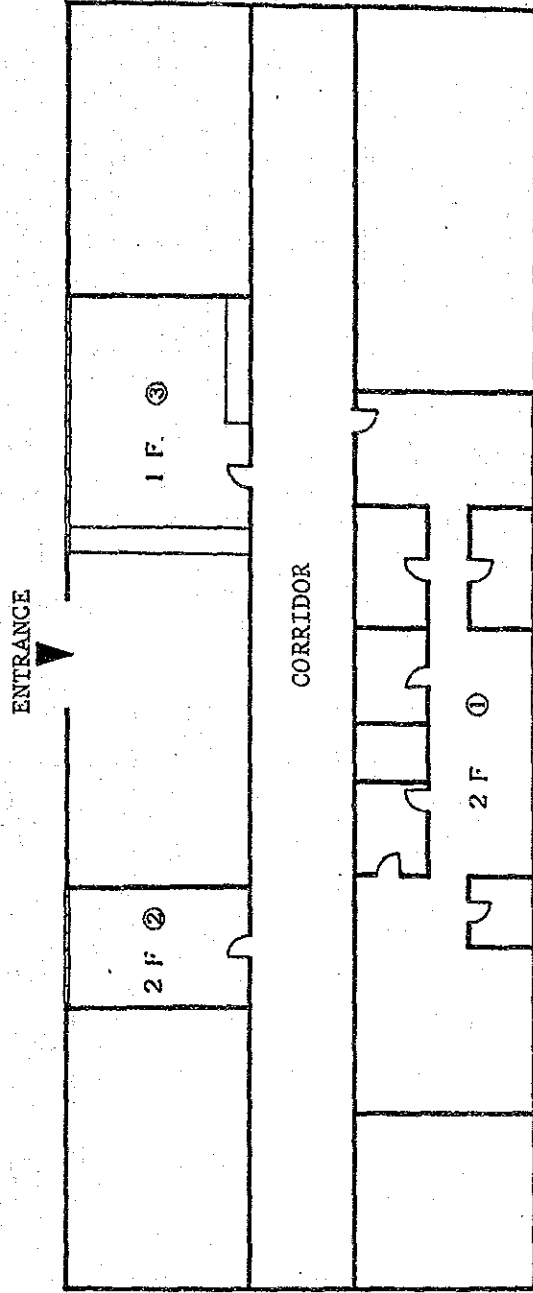


Figure 4.3.2 Layout Plan of Laboratories (5)

Department: Materials Engineering

(Building : B)

\* Letter indicates the buildings in Figure 4.3.1



1, 2F

Room No.	Laboratory Name
①	Microscopy Lab.
②	E.P.M. Room
③	Materials Testing Lab.

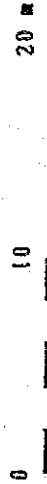


Figure 4.3.2 Layout Plan of Laboratories (6)

Department: Textile Technology

(Building : D)

\* Letter indicates the buildings in Figure 4.3.1

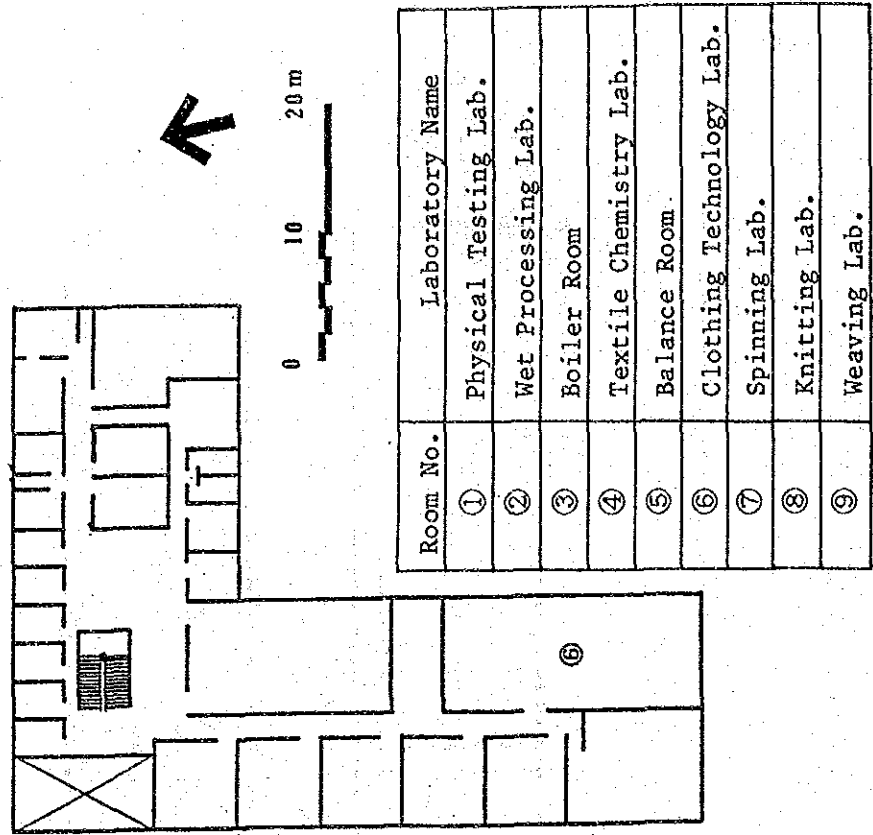
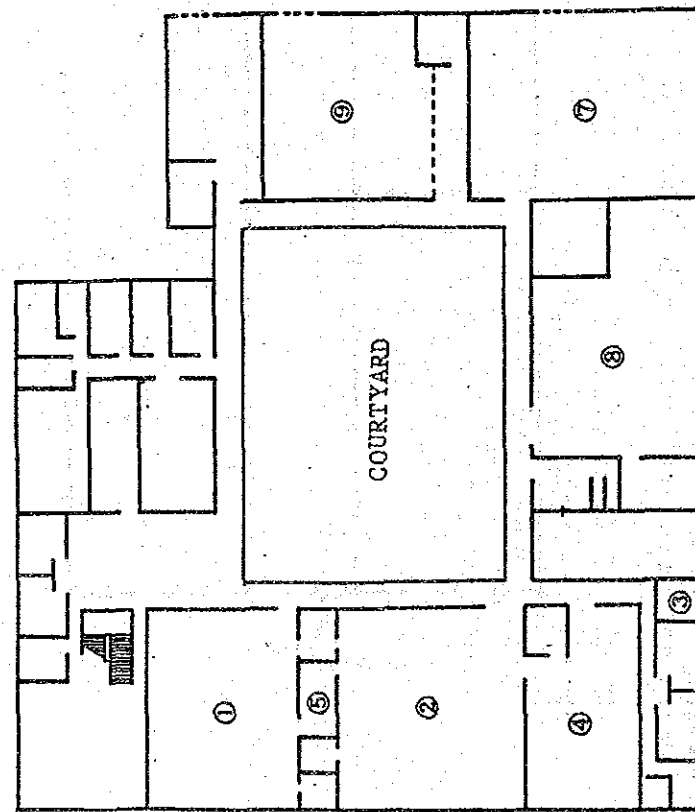


Figure 4.3.2 Layout Plan of Laboratories (7)



Table 4.3.1 Layout Plan of Equipment (1)

Department/Laboratory	Room Size (m)	Utilities	Equipment name
- Electrical Measurements Lab. (Electrical Eng.)	169m <sup>2</sup> (9.4x18.0)	Electricity 230V/400V	EE-1 Clip on AC power meter, EE-8 Galvanometer, EE-18 Portable lux meter, EE-19 Portable wheatstone bridge, EE-20 Analog multimeter, EE-21 DC power supply, EE-22 Function generator, EE-23 Oscilloscope
		Water -	
		Air-cond. -	
- Electrical Wiring Lab.	135m <sup>2</sup> (9.4x14.4)	Electricity 230V	EE-26 Metric wire gauge, EE-27 Micrometer
		Water -	
		Air-cond. -	
- Electrical Power System Lab.	169m <sup>2</sup> (9.4x14.4)	Electricity 230V/400V	EE-1 Clip on AC power meter, EE-5, 6 Electrostatic voltmeter, EE-14 Single-phase power transducer, EE-15 Three-phase four wire power transducer, EE-16 Single-phase power factor transducer, EE-23 Oscilloscope, EE-24 Digital storage-scope, EE-46 Solar meter, etc.
		Water -	
		Air-cond. Yes	
		Electricity 230V/400V	
- Electrical Machines Lab.	367m <sup>2</sup> (9.4x40.0)	Electricity 230V/400V	EE-2 Gauss meter, EE-3 Gauss meter probes, EE-4 Search coil for electronic flux meter, EE-11, 12, 13 Pocket tachometer, EE-20 Analog multimeter, EE-21 DC power supply, EE-23 Oscilloscope, EE-24 Digital storage-scope, EE-25 Clip-on ammeter, EE-33 Induction voltage regulator, EE-36 Phase-sequence detector, etc.
		Water -	
		Air-cond. -	
		Electricity 230V/400V	
- High Voltage Lab.	68m <sup>2</sup> (9.4x7.2)	Electricity 230V/400V	EE-17 Insulation polytester, EE-24 Digital storage-scope, EE-45 Portable oil test set, EE-47 600KV impulse generator
		Water -	
		Air-cond. -	
- Electronic & Telecommunication Eng.) - Computer System Lab.	158m <sup>2</sup> (7.2x22.0)	Electricity 400V	EET-2 Analog computer, EET-3 Model computer training kit, EET-5 Digital multimeters, EET-6 variable DC power supply, EET-7 Four channel oscilloscope, EET-35 Analysing recorder, EET-38 Uninterruptible power supply, EET-45 Digital plotter, EET-49 Robotics teaching experimenting kit, etc.
		Water Yes	
		Air-cond. Yes	
		Electricity 400V	

Table 4.3.1 Layout Plan of Equipment (2)

Department/Laboratory	Room Size (m)	Utilities	Equipment name
- Work shop	144m <sup>2</sup> (7.2x20.0)	Electricity 400V Water Yes Air-cond. -	EET-1 Auto transformer, EET-5 Digital multimeters, EET-9 Wideband oscilloscope, EET-34 Dual trace oscilloscope, EET-47 Miniature portable oscilloscope, EET-48 Digital storage oscilloscope, EET-59 Digital multimeters, EET-68 Auto transformer, etc.
- Microwave Lab.	68m <sup>2</sup> (7.2x9.5)	Electricity 230V Water Yes Air-cond. -	EET-5 Digital multimeters, EET-6 Variable DC power supply, EET-23 Network/Spectrum analyzer, EET-27 Sweep oscillators, EET-50 Ferrite experimental equipment, EET-59 Digital multimeters EET-66 Frequency counter.
- Telecommunication Lab.	94m <sup>2</sup> (7.2x13.0)	Electricity 230V Water Yes Air-cond. Yes	EET-5 Digital multimeters, EET-6 Variable DC power supply, EET-13 Pulse and switching circuit trainer, EET-18 Filter circuit trainer, EET-22 White noise generator, EET-26 Modulation/demodulation circuit trainer, EET-31 VHF-signal generator, EET-59 Digital multimeter, EET-62 AM/FM standard signal generators.
- T.V. Lab.	68m <sup>2</sup> (7.2x9.5)	Electricity 230V Water Yes Air-cond. Yes	EET-37 Color TV trainer
- Project Lab.	68m <sup>2</sup> (7.2x9.5)	Electricity 230V Water Yes Air-cond. -	EET-32 Pulse generator, EET-34 Dual trace oscilloscope, EET-47 Miniature portable oscilloscope, EET-5 Digital multimeters, EET-6 Variable DC power supply
- Opto Electronics Lab.	68m <sup>2</sup> (7.2x9.5)	Electricity 230V Water Yes Air-cond. Yes	EET-51 Optical fiber system

Table 4.3.1.1 Layout Plan of Equipment (3)

Department/Laboratory	Room Size (m)	Utilities	Equipment name
- Electronic Systems Lab.	79m <sup>2</sup> (7.2x11.0)	Electricity 230V	EET-8 Function generator, EET-11 Linear IC tester, EET-6 Variable DC power supply, EET-5 Digital multimeters, EET-7 four channel oscilloscope
		Water Yes	
		Air-cond. -	
- Basic Electronic Lab.	68m <sup>2</sup> (7.2x9.5)	Electricity 230V	EET-16 Power supply circuit trainer, EET-12 Transistor circuit trainer, EET-15 Thyristor circuit trainer, EET-5 Digital multimeters, EET-7 Four-channel oscilloscope
		Water Yes	
		Air-cond. -	
- Digital Electronic Lab.	79m <sup>2</sup> (7.2x11.0)	Electricity 230V	EET-14 A/D, D/A converter circuit trainer, EET-19 Digital system trainer, EET-6 variable DC power supply
		Water Yes	
		Air-cond. -	
- Industrial Electronic Lab.	58m <sup>2</sup> (7.2x8.0)	Electricity 230V	EET-17 Servomechanism experimental equipment, EET-33 LCR meter
		Water Yes	
		Air-cond. -	
- Physics Lab.	252m <sup>2</sup> (7.2x35.0)	Electricity 230V	EEP-2 Vernier callipers, EEP-5 Travelling micro- scope, EEP-12 Pulley and comprehensive pulley set, EEP-15 Katers reversible pendulum, EEP-18 Sodium lamp, EEP-20 Light interference apparatus, EEP-28 Diffraction grating, EEP-30 Filter color plate, EEP-37 Low-frequency osci- lloscope, EEP-43 Electronic balance, EEP-51 EP-51 sound level meter, etc.
		Water Yes	
		Air-cond. -	
(Computer Science & Engineering)	16m <sup>2</sup>	Electricity 230V/400V	EOS-8 Ethernet adapter for Micro Vax-II
- CPU Room	(4.0x4.0)	Water Yes Air-cond. Yes	

Table 4.3.1 Layout Plan of Equipment (4)

Department/Laboratory	Room Size (m)	Utilities	Equipment name
- Microcomputer Lab. 01	88m <sup>2</sup> (8.0x11.0)	Electricity 230V/400V	EOS-4 Personal computer system type 1, EOS-7 Ethernet communication server, EOS-12 Image processing system, EOS-19 Digitizer.
		Water Yes	
		Air-cond. Yes	
- Microcomputer Lab. 02	94m <sup>2</sup> (8.5x11.0)	Electricity 230V/400V	EOS-5 Personal computer system type 2, EOS-7 Ethernet communication server
		Water Yes	
		Air-cond. Yes	
- Maintenance Centre	88m <sup>2</sup> (8.0x11.0)	Electricity 230V/400V	EOS-25 Logic analyzer, EOS-26 Digital storage oscilloscope, EOS-27 oscilloscope, EOS-29 Curve tracer, EOS-30 Wide function synthesizer, EOS-31 Spectrum analyzer, EOS-32 Sweep/function generator
		Water Yes	
		Air-cond. -	
- New CPU Room	40m <sup>2</sup> (10.0x4.0)	Electricity 230V/400V	EOS-1 Computer system 1, EOS-2 Computer system 2, EOS-3 Engineering workstation, EOS-7 Ethernet communication server, EOS-20 Plotter
		Water Yes	
		Air-cond. -	
- UPS Room	9m <sup>2</sup> (3.0x3.0)	Electricity 230V/400V	EOS-60 GP-1B, RS-232C converter & AC adapters
		Water -	
		Air-cond. -	
- Terminal Room 01	90m <sup>2</sup> (10.0x9.0)	Electricity 230V/400V	EOS-6 Personal computer system type 3, EOS-7 Ethernet communication server
		Water Yes	
		Air-cond. -	

Table 4.3.1 Layout Plan of Equipment (5)

Department/Laboratory	Room Size (m)	Utilities	Equipment name
- Data Communication Lab.	100m <sup>2</sup> (10.0x10.0)	Electricity 230V/400V	EOS-10 Digital signal processor development system, EOS-23 Ethernet LAN analyzer, EOS-28 Oscilloscope, EOS-32 Sweep/function generator, EOS-61 Centronics bus extenders & AC adapters
		Water Yes	
		Air-cond. -	
- Microcomputer Systems Design Lab.	100m <sup>2</sup> (10.0x10.0)	Electricity 230V/400V	EOS-9 Microcomputer software and hardware development system, EOS-11 Multiprocessing system, EOS-15 Robot, EOS-16 Z80 in circuit emulator, EOS-28 Oscilloscope, EOS-32 Sweep/function generator, etc.
		Water Yes	
		Air-cond. -	
- Digital Instrumentation Lab.	110m <sup>2</sup> (11.0x10.0)	Electricity 230V/400V	EOS-13 Multipurpose microcomputer experiment system, EOS-24 GP-IB bus monitor, EOS-28 Oscilloscope, EOS-32 Sweep/function generator, EOS-61 Centronics bus extender & AC adapters
		Water Yes	
		Air-cond. -	
- Terminal Room 02	85m <sup>2</sup> (8.5x10.0)	Electricity 230V/400V	EOS-6 Personal computer system type 3, EOS-7 Ethernet communication server
		Water Yes	
		Air-cond. -	
(Chemical Eng./Chemical Eng. Div.) - Unit Operations Lab.	840m <sup>2</sup> (28.0x30.0)	Electricity 230V/400V	EC-2 Continuous stirred tank reactor, EC-4 Heat transfer teaching unit, EC-9 Wiped film evaporator, EC-10 Universal mixer for all liquid, EC-12 Semi-pilot scale solid liquid extraction unit, EC-13 Apparatus for determining heat loss from bare and lagged pipes, EC-16 Continuous crystallizing system
		Water Yes	
		Air-cond. -	
- Analytical Lab.	588m <sup>2</sup> (28.0x21.0)	Electricity 230V	EC-5 Spectro colorimeter, EC-14 Gas chromatograph, EC-15 Atomic absorption spectrophotometer
		Water Yes	
		Air-cond. Yes	

Table 4.3.1 Layout Plan of Equipment (6)

Department/Laboratory	Room Size (m)	Utilities	Equipment name
- Fuel Teaching Lab.	2,340m <sup>2</sup> (30.0x78.0)	Electricity 230V/400V	EC-3 Continuous catalytic tubular reactor, EC-6 Surface area measurement of solid/powder complete unit
		Water Yes	
		Air-cond. Yes	
- Process Control Lab.	672m <sup>2</sup> (28.0x24.0)	Electricity 230V/400V	EC-1 Process simulation equipment, EC-7 Refrigerated high speed centrifuge, EC-8 Equipment test bench to study analogy between fluid fraction and heat transfer, EC-11 Filterability index apparatus
		Water Yes	
		Air-cond. Yes	
(Chemical Eng./Polymer Technology Div.) - Processability Lab.	52m <sup>2</sup> (5.6x9.3)	Electricity 230V/400V	ECP-1 Capirograph, ECP-2 Conical disk rehometer, ECP-3 Labo.plastomill
		Water Yes	
		Air-cond. Yes	
- Processing Lab.	130m <sup>2</sup> (9.3x14.0)	Electricity 230V/400V	ECP-4 Small test press, ECP-5 Internal dispersive mixer, ECP-6 Extruder, ECP-7 Film blowing system, ECP-8 Injection moulding machine, ECP-9 Cost film attachment, ECP-10 Pelletising attachment, ECP-11 Blow moulding attachment
		Water Yes	
		Air-cond. Yes	
(Materials Eng.) - Microscopy Lab.	306m <sup>2</sup> (9.0x34.0)	Electricity 230V	EM-1 Scanning electron microscope, EM-2 Polarizing microscope, EM-5 X-ray diffractometer.
		Water Yes	
		Air-cond. Yes	
- E.P.M. Room	47m <sup>2</sup> (5.2x9.0)	Electricity 230V	EM-3 Thermal analysis device, EM-4 IR spectrophotometers
		Water Yes	
		Air-cond. Yes	

Table 4.3.1 Layout Plan of Equipment (7)

Department/Laboratory	Room Size (m)	Utilities	Equipment name
- Materials Testing Lab.	106m <sup>2</sup> (9.0x11.8)	Electricity 230V/400V	EM-6 Universal fatigue testing machine, EM-7 Universal testing machine
		Water Yes	
		Air-cond. -	
(Textile Technology Dept.) - Physical testing Lab.	192m <sup>2</sup> (12.0x16.0)	Electricity 230V/400V	ETC-2 Perspiration meter, ETC-4 High temperature steaming tester, ETC-7 1 colour printing machine, ETC-10 Vertical drive 8-colour dyeing tester, ETC-12 Electric reading analytical balance, ETC-14 Drycleaning test instrument, ETC-15 Textile shrinkage percentage tester, ETC-16 Flat-bed press, ETC-18 Flammability speed tester, ETC-20 Spray tester, ETC-22 Spectro-colour meter, ETC-23 Polarizing microscope, ETC-24 Melting point apparatus. ETC-25 Air pump, ETC-26 De-ioniser, ETC-27 Centrifuge, ETC-29 Hot air circulating type electric dyeing oven, ETC-30 Tensile & Shear tester, ETC-31 Steam generator, ETC-33 Bursting strength tester, ETC-34 Fray counter
		Water Yes	
		Air-cond. Yes	
- Wet Processing Lab.	240m <sup>2</sup> (16.0x15.0)	Electricity 230V/400V	
		Water Yes	
		Air-cond. -	
- Boiler Room	12m <sup>2</sup> (3.5x3.5)	Electricity 230V/400V	
		Water Yes	
		Air-cond. -	
- Textile Chemistry Lab.	306m <sup>2</sup> (9.0x34.0)	Electricity 230V	
		Water Yes	
		Air-cond. Yes	
- Balance Room	18m <sup>2</sup> (6.0x3.0)	Electricity 230V	
		Water Yes	
		Air-cond. Yes	

Table 4.3.1 Layout Plan of Equipment (8)

Department/Laboratory	Room Size (m)	Utilities	Equipment name
- Clothing Technology Lab.	180m <sup>2</sup> (9.0x20.0)	Electricity 230V/400V	ETL-2 Industrial sewing m/c with needle-feeding device, ETL-16 Deck sewing m/c, ETL-19 Pattern fixing pin table, ETL-20 Fabric spreading m/c, ETL-38 Textography material saving system, ETL-39 Programmable sewing m/c, ETL-40 Multiple needles, ETL-49 Pressing equipment, etc.
		Water Yes	
		Air-cond. Yes	
- Spinning Lab.	270m <sup>2</sup> (15.0x18.0)	Electricity 230V/400V	ETS-1 Miniature card, ETS-2 Miniature draw-frame, ETS-3 Miniature ring frame, ETS-4 High speed card, ETS-5 Drawing frame, ETS-8 Fly frame, ETS-9 Ring frame, ETS-10 Auto cone winder, ETS-12 Two for one twister, ETS-15 Fancy yarn spinner
		Water Yes	
		Air-cond. Yes	
- Knitting Lab.	260m <sup>2</sup> (13.0x20.0)	Electricity 230V/400V	ETN-1 Semi-full fashion flat knitting machine, ETN-3, 4 Hand flat knitting machine, ETN-5 Circular weft knitting machine
		Water Yes	
		Air-cond. Yes	
- Weaving Lab.	248m <sup>2</sup> (15.0x16.5)	Electricity 230V/400V	ETW-1 Auto pirnwinder, ETW-5 Drawing in m/c, ETW-6 Rapiet loom, ETW-7 Dobby-20 shafts, ETW-8 Air-jet loom, ETW-19 Air compressor, ETW-20 Water-jet loom.
		Water Yes	
		Air-cond. Yes	
(Common Facility/Library) - Lending Div.	500m <sup>2</sup> (30.0x17.0)	Electricity 230V/400V	CL-1 Book stock shelving, CL-2 Compact mobile shelving system, CL-3 Work room shelving, CL-4 Journal display & storage, CL-5 Storage cabinets, CL-6 Atlas stands, CL-7 Dictionary stands, CL-8 Storage systems. CL-9 Open study carrels.
		Water Yes	
		Air-cond. Yes	
- Periodicals Div.	150m <sup>2</sup> (15.0x10.0)	Electricity 230V/400V	CL-10 Charging desks, CL-11 Book trucks, CL-12 Card catalogue cabinets, CL-13 Equipment for mounting displays, CL-14 Microfilm reader, CL-15 Microfilm processor, CL-16 Library bindery.
		Water Yes	
		Air-cond. Yes	



Table 4.3.1 Layout Plan of Equipment (9)

Department/Laboratory	Room Size (m)	Utilities	Equipment name
- Reference Div.	150m <sup>2</sup> (15.0x10.0)	Electricity 230V	
		Water Yes	
		Air-cond. Yes	
(Common Facility) - Language Lab.	72m <sup>2</sup> (9.0x8.0)	Electricity 230V	LL-1 Language laboratory system, LL-2 Video for language laboratory system
		Water Yes	
		Air-cond. Yes	
(Common Facility/Physical Education) - Sport Counsel Room	55m <sup>2</sup> ( 7.2x7.7)	Electricity 230V	CR-7 Weighing machine, CP-8 Weight lifting set
		Water Yes	
		Air-cond. -	
- Gymnasium	600m <sup>2</sup> (25.0x24.0)	Electricity 230V/400V	CP-1 Parallel bars, CP-2 Vaulting box
		Water Yes	
		Air-cond. -	
- Boat Room	500m <sup>2</sup> (30.0x17.0)	Electricity 230V/400V	CP-3 Sculling exercise machine, CP-8 Marine training boat
		Water Yes	
		Air-cond. Yes	

Table 4.4.1 Required Supervisory Work (1)

Item	Man/Day	Service
(Department of Electrical Engineering) .EE-47 600 KV impulse generator	10	Supervision for Installation, Adjustment, Commissioning
(Department of Electronic & Telecommunication Engineering) .EET-75 CNC Vertical machining center	15	"
.EET-76 CNC teaching/training lathe	10	"
(Department of Computer Science & Engineering) .EOS-1,2,3 Computer system	2x60	"
.EOS-66 Uninterruptible power supply	10	"
.EOS-67 Air conditioning equipment	40	"
(Department of Chemical Engineering) .EC-1,2,4 Process simulation equipment, Continuous stirred tank reactor, Heat transfer teaching unit	5	Supervision for Adjustment, Commissioning
.EC-3,16 Continuous catalytic tubular, Continuous crystallizing system	5	Supervision for Adjustment, Commissioning
.EC-10 Universal mixer for all liquid	5	"
.EC-14 Gas chromatograph	5	"
.EC-5,15 Spectro colorimeter, Atomic absorption spectrophotometer	5	"
.ECP-8 Injection moulding machine	10	"

Table 4.4.1 Required Supervisory Work (2)

Item	Man/Day	Service
(Department of Materials Engineering)		
.EM-1 Scanning electron microscope	10	Supervision for Adjustment, Commissioning
.EM-3 Thermal analysis device	10	
.EM-5 X-ray diffractometer	10	
(Department of Textile Technology)		
.ETC-2,3,4,5 Perspiration tester, Iron tester, High temperature steaming tester, Pin-tester type thermosoling and baking machine	14	"
.ETC-6,7,8 Auto-screen printing machine, colour printing machine, Calendering machine	8	"
.ETC-10,14,15,17,20 Vertical drive 8 colour dyeing tester, Dry-cleaning test instrument, Textile shrinkage percentage tester, Knit shrinkage tester, Spray tester	8	"
.ETL-2,3,4,5,6,14,16,17 Industrial sewing m/c with feeding device, Industrial sewing m/c with differential feeding device, Lock sewing m/c, Hemming m/c, Button m/c with button feeder, Industrial sewing m/c with thread cutting device, Deck sewing m/c, Flat 3 needle m/c.	14	"
.ETL-9,10,19,20 Cloth cutting devices, Iron table, Pattern-fixing pin table, Fabric spreading m/c	6	"

Table 4.4.1 Required Supervisory Work (3)

Item	Man/Day	Service
.ETS-1,2,3,4 Miniature card, Miniature draw frame, Miniature ring frame, High speed card	10	"
.ETS-5 Drawing frame	6	"
.ETS-8 Fly frame	6	Supervision for Adjustment, Commissioning
.ETS-9 Ring frame	6	"
.ETS-10,11 Auto cone winder, Doubler winder	6	"
.ETS-13 Open end spinner	6	"
.ETN-1 Semi full fashion flat knitting m/c	9	"
.ETN-3,4,5 Single bed hand flat knitting m/c, Double bed hand flat knitting m/c, Circular weft knitting m/c	6	"
.ETW-5 Drawing in m/c	10	"
.ETW-6,7,8,20 Rapier loom, Dobby-20 shafts, Air jet loom, Water jet loom	10	Supervision for Installation, Adjustment, Commissioning
(Common Facility)		
LL-1 Language Laboratory system	20	"
<b>Total (31 items/32 persons)</b>	<b>415</b>	<b>-</b>

TABLE 4.4.2

(1)

<u>LIST OF EQUIPMENT</u>			
FACULTY OF ENGINEERING DEPARTMENT OF ELECTRICAL ENGINEERING			
ITEM NO.	EQUIPMENT NAME	Q'ty	DESCRIPTION
EE- 1	Clip on AC power meter	6 ea.	Digital display, ranges 200-600V, 2-20A, 2-20KW
EE- 2	Gauss meter	1 ea.	20-20,000 gauss
EE- 3	Gauss meter probes	1 ea.	Flat for measurement in narrow gaps
		1 ea.	Sturdy flat probe
		1 ea.	Axial probe
EE- 4	Search coil for electronic flux meter		<u>Inside are. of coil</u>
		1 ea.	25 cm <sup>2</sup> ( 40 turn)
		1 ea.	6 cm <sup>2</sup> (100 turn)
		1 ea.	3 cm <sup>2</sup> ( 10 turn)
EE- 5	Electrostatic voltmeter	1 ea.	Portable type, 2KV, AC and DC
EE- 6	Electrostatic voltmeter	1 ea.	Portable type, 5KV, AC and DC
EE- 8	Galvanometer	3 ea.	0.9 A/div, 540 V/div
EE-10	Precision double bridge	1 ea.	0.1mohm-111.1 ohm
	Measuring probes	1 ea.	
	Clamp device	1 ea.	
EE-11	Pocket tachometer	2 ea.	Touchless, using a photo probe, 2000-20,000rpm
EE-12	Pocket tachometer	2 ea.	Touch, using a contact rubber tips, 2000-20,000rpm
EE-13	Pocket tachometer	2 ea.	Touchless, using a photo probe, 2000-20,000rpm with probe fixture and analog output lead
EE-14	Single-phase power transducer	2 ea.	Input 110VAC, 5A Output 0-5VDC with watt meter
EE-15	Three-phase four-wire power transducer	2 ea.	Input 110VAC, 5A Output 0-5VDC with watt meter
EE-16	Single-phase power factor transducer	2 ea.	Input 110VAC, 5A Output 0-+1V with p.f. meter
EE-17	Insulation polytester	1 ea.	500V/100Mohm, 0-15/150/1500 ohm
EE-18	Portable lux meter	1 ea.	0-3,000 lux
EE-19	Portable wheatstone bridge	2 ea.	With murray and varley loop tester, 1 ohm-10 Mohm
EE-20	Analog multimeter	6 ea.	AC-DC voltage 1000V, DC current 500mA
EE-21	DC power supply	6 ea.	0-32V, 0.5A
EE-22	Function generator	2 ea.	0.0001Hz-20MHz Sine, triangular and square
EE-23	Oscilloscope	10 ea.	20MHz, 2 channel

TABLE 4.4.2

(2)

ITEM NO.	EQUIPMENT NAME	Q'ty	DESCRIPTION
EE-24	Digital storage-scope	3 ea.	20MHz, 2 channel, memory capacity 1KB
EE-25	Clip on ammeter	4 ea.	15-300A AC
EE-26	Metric wire gauge	2 ea.	BWG 0-36
EE-27	Micrometer	2 ea.	0.25mm (range) in 0.01mm (grad.)
EE-28	Insulated terminals	1,000 pcs.	10A, 200 each of black, red, yellow, blue, brown
EE-29	Digital millisecond counter	1 ea.	0-999.9 sec., for measuring, operating and reset times of relay and contacts
EE-33	Induction voltage regulator	1 ea.	Output 30KVA Input 400V, 3 phase, 50Hz
EE-35	Microcomputer controlled DC motor training unit	1 set	GPU Z80A, with DC motor training unit and DC power supply unit
EE-36	Phase sequence detector	3 ea.	110-480V, 40-70Hz
EE-37	Power electronics basic demonstration set	1 set	For studying phase shift control, rectification, switching, etc.
EE-38	Plastic coated white steel morning board	2 ea.	Wall mountable or movable type (4' x 6')
EE-39	Thyristor leonard experiment system (Variable speed system of DC Motor)	1 set	DC motor 2KW
EE-40	3-phase controlled DC motor drive	1 set	Input 400VAC, 50Hz, 3 phase, Output 0-100VDC, 30A
EE-41	Chopper driven DC motor	1 set	DC motor 70/90V, 250W, 1800rpm
EE-42	Thyristor inverter system trainer	1 set	Input 400V, 50Hz, 3 phase, rated current 10A
EE-43	(Combined with EE-42)		
EE-44	Microprocessor controlled electronics equipment	1 set	For studying transistor inverter drive of AC motor, microprocessor controlled AC/DC motor, etc.
EE-45	Portable oil test set	1 set	0.5kVA, 0-60KV
EE-46	Solar meter	1 ea.	
	Solar recorder	1 ea.	
	Solar integrator	1 ea.	
	Solar cell	1 ea.	5mA, 100mV, 100mW/cm <sup>2</sup>
EE-47	600KV impulse generator	1 set	Including generator body, charging power source, control panel, wave front monitor, etc.
EE-48	Uninterruptible power supply	1 set	Output 3kVA, 230VAC, 50Hz Input 230VAC
EE-49	Air conditioners	5 ea.	Window type 230VAC, 1 phase, 24,000BTU/h

TABLE 4.4.2

(3)

<u>LIST OF EQUIPMENT</u>			
FACULTY OF ENGINEERING DEPARTMENT OF ELECTRONIC & TELECOMMUNICATION ENGINEERING			
ITEM NO.	EQUIPMENT NAME	Q'ty	DESCRIPTION
EET- 1	Auto transformer	5 ea.	Input 230V, 50Hz, 1 phase    Output 0-260V, 3A
EET- 2	Analog computer	1 set	Operating mode: high speed, low speed, and repetitive operation
EET- 3	Model computer training kit with display panel	1 set	Operating system: binary 8 bits parallel summing system
EET- 5	Digital multimeters	15 ea.	For DCV, ACV, DCA, ACA, R measurements
EET- 6	Variable DC power supply	8 ea.	Dual tracking type
EET- 7	Four channel oscilloscopes	2 ea.	350MHz, with GPIB
EET- 8	Function generator	2 ea.	0.01Hz-10MHz, Sine, triangular, square, ramp wave, pulse wave
EET- 9	Wideband oscillators	8 ea.	2Hz-20MHz, sine
EET-11	Linear IC tester	1 ea.	Test items: +DUT supply current, input Offset volt., etc.
EET-12	Transistor circuit trainer	1 set	Including experimental circuit panel, accessory kit, etc.
EET-13	Pulse and switching circuit trainer	1 set	Including multi-vibrator circuit panels, integration panels, etc.
EET-14	A/D, D/A converter circuit trainer	1 set	Including A/D and D/A conversion experimental equipment
EET-15	Thyristor circuit trainer	1 set	For studying thyristor operation, phase shift control, rectification, etc.
EET-16	Power supply circuit trainer	1 set	For studying rectifying circuit, stabilized circuit, etc.
EET-17	Servomechanism experimental equipment	1 set	For studying control synchro transmitter, two-phase servo-motor, etc.
EET-18	Filter circuit trainer	1 set	Including low-pass filter, high-pass filter, etc.
EET-19	Digital system trainer	1 set	For studying binary number calculation and basic logic
EET-22	White noise generator	1 ea.	50KHz
EET-23	Network/spectrum analyzer	1 ea.	100KHz-2GHz
EET-26	Modulation/demodulation circuit trainer	1 ea.	Including AM, FM modulator/demodulator, etc.
EET-27	Sweep oscillators	1 ea.	5.9-12.4GHz
EET-31	VHF signal generator	1 ea.	100KHz-2GHz
EET-32	Pulse generator	2 ea.	10Hz-50MHz

TABLE 4.4.2

(4)

ITEM NO.	EQUIPMENT NAME	Q'ty	DESCRIPTION
EET-33	LGR Meter	1 ea.	1KHz-100Hz with GPIB
EET-34	Dual trace oscilloscope	4 ea.	40MHz
EET-35	Analysing recorder	1 ea.	4ch., 32K words/ch. with GPIB
EET-37	Color TV trainer	1 set	For studying high-frequency circuit experiment, etc.
EET-38	Uninterruptible power supply	2 sets	3KVA, 230VAC, 50Hz
EET-40	Acoustic circuit trainer	1 set	Including power amplifier, voltage amplifier, condenser microphone, etc.
EET-41	Dual trace oscilloscope	1 ea.	Specification same as EET-34
EET-45	Digital plotter	1 ea.	8pen, RS232C & HPIB, 80cm/s
EET-47	Miniature portable oscilloscope	1 ea.	Dual trace, 40MHz
EET-48	Digital storage oscilloscope	1 ea.	60MHz, GPIB programmable
EET-49	Robotics teaching experimenting kit	1 set	Articulated robot, 5 axis
EET-50	Ferrite experimental equipment set	1 set	Including Faraday rotation apparatus, square circular transition wave guide, etc.
EET-51	Optical fiber system	1 set	System includes optical fiber cables (GI, SI), stabilized LD light source, detector, laser diodes, variable attenuator, connectors, adaptors, termination kit, fiber cutter.
EET-53	(EET-53 to EET-56 are brought together into EET-51 as one system.)		
EET-54			
EET-55			
EET-56			
EET-57	Dual trace oscilloscopes	3 ea.	(Specification same as EET-34)
EET-59	Digital multimeters		(Specification same as EET-5. Total quantity included in EET-5.)
EET-60	RF/AF generators		(Specification same as EET-29. Total quantity included in EET-29.)
EET-62	AM/FM standard signal generators	2 ea.	100KHz-110MHz
EET-66	Frequency counter	1 ea.	10Hz-18GHz
EET-68	Auto transformer	1 ea.	Input 230V, 50Hz, 1 phase Output 0-260V, 10A
EET-71 (N.R.I.)	Hand held polaroid oscilloscope Camera (Inclusive of polaroid auto film)	1 ea.	For items EET-7 and EET-48
EET-72 (N.R.I.)	Calibrator, arbitrary standard type	1 ea.	Calibrators of DMTs, circuit meters, etc.



TABLE 4.4.2

(5)

ITEM NO.	EQUIPMENT NAME	Q'ty	DESCRIPTION
EET-73 (N.R.I.)	Precision digital meter	1 ea.	+100mV to +1000VDC, 100 ohm to 100 M ohm, 1V to 500VAC
EET-74 (N.R.I.)	Portable cassette data recorder	1 ea.	FM (DC-10KHz) and optional DR (200Hz - 36KHz) recording system
EET-75 (N.R.I.)	CNC vertical machining center	1 set	
EET-76 (N.R.I.)	CNC teaching/training lathe	1 set	

TABLE 4.4.2

(6)

<u>LIST OF EQUIPMENT</u>			
FACULTY OF ENGINEERING DEPARTMENT OF ELECTRONIC & TELECOMMUNICATION ENGINEERING Physics Laboratory			
ITEM NO.	EQUIPMENT NAME	Q'TY	DESCRIPTION
EEP- 2	Venier callipers	6 ea.	Range 150mm
EEP- 3	Micrometer screw gauge	6 ea.	Range 0-25mm
EEP- 4	Spherometer	6 ea.	Range -20 to 0 to +20mm
EEP- 5	Travelling microscope (Measuring microscope)	3 ea.	Range 200mm (horizontal), 160mm (vertical)
EEP-12	Pulley and comprehensive pulley set (Pulley demonstration set)	3 sets	Including single pulleys, double pulleys, weights, etc.
EEP-13	Inclined plane with supplementary parts	3 sets	Including slope bench and supplementary parts
EEP-15	Katers reversible pendulum	2 sets	Overall length 1,555mm approx.
EEP-16	Youngs' modulus of wires apparatus	3 sets	Including body, wall bracket, weights, brass wire, etc.
EEP-18	Sodium lamp (Line spectrum light source)	3 ea.	For studying observation of line spectrum, interference and diffraction
EEP-19	Solar cell experimental apparatus	3 sets	Including solar cell, DC motor, etc.
EEP-20	Light interference apparatus	2 sets	9 slits and 2 parallel slits in the cylinder
EEP-26	Spectroscopic prism	6 ea.	60° flint glass prism
EEP-27	Spectrometer	3 ea.	Including flint prism, collimeter, etc.
EEP-28	Diffraction grating	3 ea.	Graded area 20x25mm
EEP-29	Newton ring experimental apparatus with optional accessories	3 sets	Including Newton's ring plate, telescope, screw micrometer, etc.
EEP-30	Filter color plate	3 ea.	Including infrared ray transmission filters and color glass filters
EEP-34	Digital multimeter	3 ea.	DCV, ACV, DCA, ACA, ohm measurements
EEP-36	Battery checker	1 ea.	1.5 to 70V
EEP-37	Low frequency oscillator	2 ea.	5Hz to 500KHz
EEP-38	Dual trace oscilloscope	2 ea.	DC to 20MHz
EEP-43	Electronic balance	1 ea.	5,000g
EEP-44	Microwave basic experimental equipment	1 set	Including gun osc., power supply, attenuator, etc.
EEP-45	Radio wave demonstration unit (Microwave)	1 set	10,525MHz, 15mW

TABLE 4.4.2

(7)

ITEM NO.	EQUIPMENT NAME	Q'ty	DESCRIPTION
EEP-46	X' ray apparatus for educational use	1 set	Including X ray tube, fluorescent plate, etc.
EEP-47	e/m apparatus	1 set	To measure e/m of electron
EEP-48	Standard tuning forks	2 sets	Including a set of thirteen forks, etc.
EEP-49	Sonometer large type	2 ea.	Including two strings, resonance box, etc.
EEP-51	Sound level meter	2 ea.	40 to 120dB
EEP-53	Variable AC supply	3 ea.	2KVA, 0-280V
EEP-54	DC voltage supply	3 ea.	0-18V, 0.55-5.5A

TABLE 4.4.2

(8)

<u>LIST OF EQUIPMENT</u>			
FACULTY OF ENGINEERING DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING			
ITEM NO.	EQUIPMENT NAME	Q'ty	DESCRIPTION
*EOS- 1	Computer system 1	1 set	32 bit, 16MB memory, hard disk 150MB, 400MB, including line printer, console, etc.
*EOS- 2	Computer system 2	1 set	32 bit, 8MB memory, hard disk 150MBx2, including console, etc.
*EOS- 3	Engineering workstation	1 set	32 bit, 4MB memory, hard disk 150MB including laser printer, bit mapped controller, etc.
*EOS- 4	Personal computer system type 1	5 sets	CPU 80286 or 80386, 3MB memory including mouse, printer, printer buffer
*EOS- 5	Personal computer system type 2	5 sets	CPU 80286, 1MB memory, 20MB hard disk
*EOS- 6	Personal computer system type 3	20 sets	GPU 80286, 1MB memory, etc.
*EOS- 7	Ethernet communication server	5 sets	RS232C 8 lines, TCP/IP protocol
*EOS- 8	Ethernet adapter for Micro Vax-II	1 set	Bus DEC Q22
*EOS- 9	Microcomputer software and hardware development system	1 set	With P-ROM writer, in-circuit emulator control card, printer, etc.
*EOS-10	Digital signal processor development system	1 set	With TMS32020 signal processor, printer, etc.
*EOS-11	Multi processor system	1 set	With mouse, multiprocessor board, printer, etc.
*EOS-12	Image processing system	1 set	With image scanner interface, TV camera interface, etc.
*EOS-13	Multipurpose microcomputer experiment system	2 sets	With printer, A/D and D/A converter card, etc.
EOS-15	Robot	1 set	Vertical multi-joint type, 5 degree of freedom, etc.
EOS-16	Z80 in-circuit emulator	2 sets	For Z80, Z80A, Z80B
*EOS-19	Digitizer	1 set	A0 size, electromagnetic induction type
*EOS-20	Plotter	1 set	A3 size, RS232C & Centronics interface outlook
*EOS-22	Computer image projector	1 set	Placed on an overhead projector
*EOS-23	Ethernet LAN analyzer	1 set	Ethernet LAN, TCP/IP protocol

NOTE : \* shows equipment which is part of a computer network system.

TABLE 4.4.2

(9)

ITEM NO.	EQUIPMENT NAME	Q'ty	DESCRIPTION
EOS-24	GP-IB bus monitor	1 set	RS232C or Centronics interface printer
EOS-25	Logic analyzer	1 set	100MHz 16 ch. timing analyzer, 20MHz 96ch. state/timing analyzer
EOS-26	Digital storage oscilloscope	1 ea.	100MHz, 2 ch.
EOS-27	Oscilloscope	1 ea.	DC to 150MHz, 5ch.
EOS-28	Oscilloscope	6 ea.	DC to 40MHz
EOS-29	Curve tracer	1 ea.	120Hz or 100Hz
EOS-30	Wide function synthesizer	1 set	0.1mHz-1.2MHz
EOS-31	Spectrum analyzer	1 set	10KHz-3.6GHz
EOS-32	Sweep/function generator	8 ea.	0.002Hz-2MHz
EOS-33	Pulse generator	2 ea.	1.0Hz-10MHz
EOS-34	IC logic tester	1 set	For TTL, CMOS, memory IC
EOS-35	Digital multimeter	2 ea.	Logic probe type
EOS-36	Digital multimeter	1 ea.	Sampling time 1,000 times/sec., with GPIB
EOS-39	Analog meters	6 ea.	DC ammeters and DC voltmeters (class 1.0)
EOS-40	Circuit testers	8 ea.	Type A and type B
EOS-41	Digital logic probes	10 ea.	For bipolar IC and CMOS IC
EOS-42	Components	1 set	68000 CPU board, VME box, etc.
EOS-43	Protoboards	52 ea.	Solderless breadboards
EOS-44	IC test crip	9 sets	Number of pins : 16 - 40
EOS-45	Power supplies	12 ea.	0-32V
EOS-46	Switching power supply	10 ea.	Output: +5V 2A, +12V 0.3A, -12V 0.2A
EOS-47	Logic trainer	4 sets	Including flip-flop, Nand, clock circuits, etc.
EOS-48	Slow scan computer	3 sets	Z80 CPU, 32 bytes RAM
EOS-49	A/D, D/A circuit trainers	1 set	Including A/D and D/A converter units
EOS-50	Logic circuit experiment system	1 set	Capable to study gate, flip-flop, function circuits, etc.
EOS-51	Z80 Microcomputer training box	2 sets	CPU Z80, 2KB ROM and RAM
EOS-52	Z80 Interface box	2 sets	Input : A/D converter input, H/L switch, etc. Output : D/A converter output, relay output, etc.
EOS-53	IC logic circuit trainer	1 set	Able to study gate circuits, flip-flop circuits, etc.
EOS-54	Microcomputer applications trainer	1 set	Including memory unit, register, counter, etc.
EOS-55	Analog computer	1 set	Operation mode : high speed, low speed and repetitive operation

TABLE 4.4.2

(10)

ITEM NO.	EQUIPMENT NAME	Q'ty	DESCRIPTION
EOS-56	Computer numerically experiment device	1 set	Linear slider, etc.
EOS-57	Video recorder	2 sets	VHS, PAL
EOS-59	Desolder cleaner	1 set	Vacuum pump 600mHg
EOS-60	GP-IB-RS232C converter & AC adapters	3 sets	GP-IB listener and talker modes
EOS-61	Centronics bus extender & AC adapters	2 sets	Max. data transfer rate 40KB/sec.
EOS-62	RS-232C patching box	1 ea.	30 pcs. bit switches patching
*EOS-63	GP-IB cable with connectors	5 ea.	2m/4m cable with connectors
*EOS-64	Ethernet cable and RS-232C cable	800 m	Ethernet cable (500m), RS232C cable (300m)
EOS-65	Transformers	5 ea.	500W, 230-110V, 50Hz
EOS-66	Uninterruptible power supply	1 set	15KVA, 3 phase 400V / 1 phase 230V
EOS-67	Air conditioning equipment	5 sets	Package-type, air cooled split, with fan coil unit

NOTE : \* shows equipment which is part of a computer network system.

TABLE 4.4.2

(11)

FACULTY OF ENGINEERING DEPARTMENT OF CHEMICAL ENGINEERING Chemical Engineering Division			
<u>LIST OF EQUIPMENT</u>			
ITEM NO.	EQUIPMENT NAME	Q'ty	DESCRIPTION
EC- 1	Process simulation equipment	1 set	Including controller, programer, recorder, etc.
EC- 2	Continuous stirred tank reactor	1 ea.	Including heater, reaction vessel: condenser, etc.
EC- 3	Continuous catalytic tubular reactor	1 ea.	Packed Column Reactor: 30Ax500L (SUS-304) Feed tank: 1 (Pyrex glass)
EC- 4	Heat transfer teaching unit	1 set	Heat exchanger: Plate, Double Pipe, Shell tube, Cross Flow
EC- 5	Spectro colorimeter	1 set	Filter spectral type photoelectric colorimeter Wavelength range: 340-950nm
EC- 6	Surface area measurement of solid/powder complete unit	1 set	Ultimate vacume: $1 \times 10^{-5}$ Torr, Gas reservoirs: 3L-1pc, 1L-2pc.
EC- 7	Refrigerated high speed centrifuge	1 set	Max speed: 22,000rpm, Max force: 50,000g Rober: 1200W, Series moter
EC- 8	Equipment test bench to study analogy between fluid friction and heat transfer	1 set	Air flow rate: 10-15m <sup>3</sup> /min, Thermostatic & Manual controlled electric heater, Heat tank with broad crest weir
EC- 9	Wiped film evaporator	1 ea.	Column; Rotary Wiper Type, Receiver and vessel: 1 (4pcs), Oil bath: Max 280 C
EC-10	Universal mixer for all liquid	1 set	Rotation speed: 150-1000rpm, solid system Differencia/movement device: Spring type
EC-11	Filterability index apparatus	1 set	Filter chamber: 120mmx120mm(5 ea.) Reservoir tank: 50 , Filter: Paper cloth
EC-12	Semi-pilot scale solid liquid extraction unit	1 set	Column: 50Ax700 (SUS-316), Feed vessel: 5 , Feed vessel heater: Heating mantle
EC-13	Apparatus for determining heat loss from bare and lagged pipes	1 ea.	Consisting of 4 lengths of standard steel pipe, mounted on a framework
EC-14	Gas chromatograph	1 set	Column oven: Ambient Temp. to 399 C, Detector: TCD, FLD, Air Compressor, H <sub>2</sub> Generator
EC-15	Atomic absorption spectrophotometer	1 set	Wavelength range: 190nm to 900nm Graphite Furnace atomizer, Detector: Photomultiplier
EC-16	Continuous crystallizing system	1 set	Tank capacity: 70L(SUS) Vacuum Receiving Tank: 35L (SUS)

TABLE 4.4.2

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FACULTY OF ENGINEERING DEPARTMENT OF CHEMICAL ENGINEERING Polymer Technology Division			
<u>LIST OF EQUIPMENT</u>			
ITEM NO.	EQUIPMENT NAME	Q'ty	DESCRIPTION
ECP- 1	Capirograph (capillary rheometer)	1 ea.	Temp. range: 60-400°C, Load detection Range: 20kgf-2000kgf
ECP- 2	Conical disk rehometer (oscillation disk rheometer)	1 ea.	Frequency of osillating disk: 100 cycles/min Temp. range: 50°C-250°C
ECP- 3	Labo. plastomill	1 ea.	Revolution: 12-120rpm, Max torque: 16kg-m Mixer: Banbury type, Temp., up to 250°C
ECP- 4	Small test press	1 ea.	Max. load: 30 tons, Max.press.: 200 kgf/cm <sup>2</sup> Pressure feed: manual hydraulic pump, Temp. range: 30-300°C
ECP- 5	Internal dispersive mixer	1 ea.	Total capacity: 3L, Working Capacity: 1L Roter revolution: Stepless variation, 5HP motor
ECP- 6	Extruder + cooling device + haul-off mechanism	1 set	Screw-size: 28mm-40mm dia. L/D = 24-25 DC drive system: 3-5HP, SCR controlled speed range of the extruder 10-200rpm
ECP- 7	Film blowing system	1 set	Adjustable vertical blown film tower, Air ring: 4 in let air ring, Bottom fed tubular die: 2 in dia.
ECP- 8	Injection moulding machine	1 ea.	Injection: Screw dia.(25mm), pressure (2070kgf/cm <sup>2</sup> )Mold clamping: Clamping force (25 ton), Mold opening force (2.5 ton)
ECP- 9	Cast film attachment (for the extruder)	1 ea.	Chilled roll dia.: 8 in, Inlet adjusting drive: 0.5HP, 12-112ft/min.
ECP-10	Pelletising attachment (for the extruder)	1 ea.	Drive system: 0.5HP drive with SCR control,Multi strand pelletizing die for 4-6 strands
ECP-11	Blow moulding attachment (for extruder)	1 ea.	Volume of the product: 30-1000CC (5-150gr.) Dia. of screw-L/D: 28-45mm, L/D=20-45 Screw speed: 10-200rpm, Dry cycle: 60-900 articles/hr. Mould clamping force: Mechanical toggle clamping



TABLE 4.4.2

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<u>LIST OF EQUIPMENT</u>			
FACULTY OF ENGINEERING DEPARTMENT OF MATERIALS ENGINEERING			
ITEM NO.	EQUIPMENT NAME	Q'ty	DESCRIPTION
EM- 1	Scanning electron microscope with all accessories and sample surface preparation unit	1 set	Resolution: 10nm, Magnification: from x50 to x100,000 Max. accelerating voltage: 25KV
EM- 2	Polarising microscope with all accessories including hot stage and camera attachments	1 set	Type: Polarising Microscope. Intermediate tube: 180° rotatable, removable analyser, Achromat stain free condenser
EM- 3	Thermal analysis device for polymers. Universal type analyser to give DTA, Dsc, TG - DTA, TMA	1 set	Essential Units: DTA, DSC, TG-DTA, TMA
EM- 4	IR spectrophotometer for polymer analysis	1 set	Double beam, optical null method. Light source:Glober, automatic intensity adjustment in three stages, Detector: Evacuated thermocouple generator: Max. tube current 250mA
EM- 5	X-ray diffractometer with goniometer and other accessories	1 set	X-ray tube: Min. output, 2KW. Goniometer: 0-20 rotation X-ray 250mA generator: Max. tube current
EM- 6	Universal fatigue testing machine	1 set	Rotating eccentric weight type, Max. repeating load: 210kgf. No. of repetitions: 1500 to 2000/min.
EM- 7	Universal testing machine	1 set	Capacity: 230 ton. For Tensile Test, Compression Test, Bending Test

TABLE 4.4.2

(14)

<u>LIST OF EQUIPMENT</u>			
FACULTY OF ENGINEERING DEPARTMENT OF MATHEMATICS			
ITEM NO.	EQUIPMENT NAME	Q'ty	DESCRIPTION
EA- 1	Microcomputer with floppy disk	3 sets	Including personal computers (3), printer (1),printer buffer (1), and software.

TABLE 4.4.2

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FACULTY OF ENGINEERING DEPARTMENT OF TEXTILE TECHNOLOGY Chemical Processing and Testing Laboratory			
<u>LIST OF EQUIPMENT</u>			
ITEM NO.	EQUIPMENT NAME	Q'ty	DESCRIPTION
ETC- 2	Perspiration meter	1 set	Test piece holding plastic plate: 21 pieces, each of 11.5x6.7cm Material of body: stainless steel
ETC- 3	Iron tester	1 set	Temp range: 100-250°C, Testing press: 60g/cm <sup>2</sup> , Control of Temp.: 2 thermister automatic thermo-controllers
ETC- 4	High temperature steaming tester	1 set	Max. press.: 4kg/cm <sup>2</sup> , Manometer: 0-6kg/cm <sup>2</sup> Material of steamer: Stainless steel. Temp. Controller: Robertshaw's automatic temp. regulator
ETC- 5	Pin-tester type thermosoling and baking machine	1 set	Working width: 120-300mm-adjustable. Max. Temp.: 230°C Processing time: 20sec-6min., by variable speed changer
ETC- 6	Auto-screen printing machine	1 set	Working width of squeegee: 300mm, Effective length of squeegeing stroke: about 350mm (Max.)
ETC- 7	1 Colour printing machine	1 set	Size of engraving roller: 260mm(w)x about 110mm(Dia.) Size of pressure roller: 250mm(w)x150mm(dia.)
ETC- 8	Calendering machine	1 set	Size of wollen paper bowl: 350mm(w)x250mm (Dia.) Size of chilled iron heating bowl: 360mm(w)x125mm(dia.)
ETC- 9	Laboratory jet dyeing	1 set	Liquid volume: 40-80L. Capacity to be dyed: 1kg(Min.). Cloth speed: 20-250M/min.
ETC-10	Vertical drive 8 colour dyeing tester	1 set	Heating method: Electric sheathed heater. Test piece hanging number: 8
ETC-11	12 colour high temp. high pressure lab. dyeing machine	1 set	Capacity of one pot: 250cc, Max. Working temp.: 140°C. Max. Working press.: 4kg/cm <sup>2</sup>
ETC-12	Electric reading analytical balance	1 set	Weighing capacity: 150-200g. Weighing range/readability: 150-200g/0.0001g. Stabilization time: 5.4 sec.
ETC-14	Dry-cleaning test instrument	1 set	Cylinder rotating speed: 40-50 rpm. Timer:0-60min.. Material of cylinder: Stainless steel
ETC-15	Textile shrinkage percentage tester	1 set	Control of Temp.: Robertshaw's automatic temperature regulator. Material: Stainless steel, Max.Temp.; 100°C
ETC-16	Flat-bed press	1 set	Temperature: 130°C-150°C. Timer: 60sec electromagnetic timer, Control of Temp.: Robertshaw's automatic temperature regulator
ETC-17	Knit shrinkage tester	1 set	Mounting pins: 20. Dia. of pin frame: Max. 14", Min.11", Strength of spring: 1 pound(160z) ±0.50Z, Loading range: 70-240g

Table 4.4.2

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ITEM NO.	EQUIPMENT NAME	Q'ty	DESCRIPTION
ETC-18	Flammability speed tester	1 set	Automatic ignition type. Material: stainless steel Test material rack; Adjustable from vertical to horizontal position
ETC-19	Accelerator	1 set	No. of rotation: 200r.p.m. (General), 4500rpm(Max.) Rotation regulator: 0-5000rpm
ETC-20	Spray tester (water repellency)	1 set	Spray nozzle: Diameter 0.889, 69 small holes, Capacity of testing water: 250ML
ETC-22	Spectro colour meter	1 set	Wavelength range: 400-700nm, 16 wave length in 20nm intervals
ETC-23	Polarizing microscope	1 set	40x-1,000x(for observation), 25x-500x (for 36mm photography)
ETC-24	Melting point apparatus (fibres)	2 sets	Measuring range: 40-300°C. Time to reach maximum temperature: 15 minutes from 30-250°C
ETC-25	Air pump (vacuum)	1 set	Rotary horizontal type. Ultimate vacume level: $10^{-3}$ Hg. Exhaust capacity: 50L/min.
ETC-26	De-ioniser	1 set	Production capacity of deionized water: 5-6L/hr. Ion exchanger: cartridge type
ETC-27	Centrifuge (bench type)	1 set	Max. speed: 3000 rpm, Rotor: Swing Rotor Basket dimension: 30cm(A)x18cm(H)
ETC-29	Hot air circulating type electric drying oven	1 set	Operating temp. range: +40-288°C, Timer: 120 min. Regulator: High sensitivity liquid type thermostatic type Material: Stainless steel
ETC-30	Tensile & shear tester with recorder and accessories	1 set	"KAWABATA" type Tensile & Shear Tester
ETC-31	Steam generator	1 set	Max. press.: 15 kg/cm <sup>2</sup> . Capacity: 120 kg/hr.
ETC-33	Bursting strength tester	1 set	Pressure range: Below 14kg/cm <sup>2</sup> . Dia. of upper clamping ring: 30.48mm. Dia. of lower clamping ring: 31.5mm
ETC-34	Fray counter	1 set	Detector: S type and F type. Fray denier: 1 denier of more

TABLE 4.4.2

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<u>LIST OF EQUIPMENT</u>			
FACULTY OF ENGINEERING DEPARTMENT OF TEXTILE TECHNOLOGY Clothing Laboratory/Sewing Machines with Special Features			
ITEM NO.	EQUIPMENT NAME	Q'ty	DESCRIPTION
ETL- 2	Industrial sewing m/c with needle feeding device with automatic thread trimmer	1 set	Sewing speed: 5,000spm. Stitch length: 4.0mm, Presser foot lifting: 10 mm. Needle bar stroke: 30.5mm
ETL- 3	Industrial sewing m/c with differential feeding device for vertical movement	1 set	Sewing speed: 4,500spm, Needle bar stroke: 30.5mm. Presser foot lift: 10mm. Walking footlift: 3mm
ETL- 4	Lock sewing m/c 2 needles, 5 threads, over-lock safety stitch machine	1 set	Sewing speed: 7,500spm. Stitch length: 2.2mm. Presser lifting: 7mm. Needle bar stroke: 24.3mm
ETL- 5	Hemming m/c for blindstitch	1 set	Sewing speed: 2,500spm. Stitch type: Single thread chain stitch blind stitch. Stitch length: 3mm(Min.)-8mm(Max.)
ETL- 6	Button m/c with button feeder	1 set	Sewing speed: 1,500spm. Needle bar stroke: 48.6mm
ETL- 7	Chain stitch m/c single needle, chain stitch	1 set	Sewing speed: 5,000spm. Stitch length: 3.6mm Presser foot lift: 6mm
ETL- 8	Cloth cutting table hanging-turning type	1 set	Cutting capacity: 6" Height. Cutting size: 72" width
ETL- 9	Cloth cutting devices with straight knife, round knife, die cutter (total 3 items) Band knife cutting m/c	1 set each	Blade size: 8", 10" (straight knife), 5" (Roundknife) 4,130mm (Band knife)
ETL-10	Iron table with vacuum Vacuum table with universal back board	1 set	Table heating element - 2.1KW, Vacuum Pump -Dry set
ETL-11	Steam iron 4 lbs. electrical	1 set	Hang water tank, Thermostat dial
ETL-12	Implements Set of pneumatic training equipment	1 lot	Set of pneumatic training equipment
ETL-13	Power punch 5 lbs, 7 1/2" height	1 set	Height: 7.5". Punching dia.: 3/64" to 3/8"
ETL-14	Industrial sewing m/c with thread cutting device High speed 1-needle lockstitch straight buttonholding m/c	1 set	Sewing speed: 3,600spm. Needle bar stroke: 30.5mm
ETL-15	Industrial sewing m/c for polo shirts, with knife	1 set	Sewing speed: 5,000 spm. Needle bar stroke: 30.5mm
ETL-16	Deck sewing m/c with single needle High speed zig-zag and embroidering m/c	1 set	Sewing speed: 2,000 spm. Stitch length (zig-zag): 0-10mm. Needle bar stroke: 33.4mm
ETL-17	Flat 3 needle m/c for decoration sewing	1 set	Sewing speed: 6,000spm. No. of stitches (per inch): 8-16. Loper stroke: 29mm. Spreader stroke: 17.6mm

TABLE 4.4.2

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ITEM NO.	EQUIPMENT NAME	Q'ty	DESCRIPTION
ETL-18	Cylinder 3 needles m/c for decoration sewing	1 set	Sewing speed: 6,000spm. Needle bar stroke: 30.6mm. No. of stitches (per inch): 8-16. Looper stroke: 29mm. Spreader stroke: 17.6mm
ETL-19	Pattern-fixing pin table	1 set	Table size: 8'(L)x5'(B), Pins on both sides
ETL-20	Fabric spreading m/c Automatic cloth spreader	1 set	Max. lay length: 6 meters. Fabric width: 1,600mm wide
ETL-21	Bar tacker sewing m/c	1 set	Sewing speed: 2,200spm. No. of stitches: 42 stitches Work clamp foot lift: 6-15mm adjustable
ETL-22	Tuck-in bar waist-rubber setting	1 set	Sewing speed: 2,000 spm. Work clamp foot lifting amount: 10mm
ETL-23	Zig/zag lock stitch	1 set	Sewing speed: 5,000spm. Max. needle throw 10mm Max. feed amount: 2.0mm. Pressure foot lift: 10mm
ETL-25	Industrial sewing m/c single needle with automatic thread cutting device, wiper & automatic reverse speed	3 sets	Sewing speed: 5,000spm. Stitch length: 4.0mm Needle bar stroke: 30.5mm. Pressure foot lift: 8.0mm
ETL-26	Industrial sewing m/c single needle with differential feeding device, automatic thread trimmer	1 set	Sewing speed: Max-4,500spm. Stitch length: Max. -5mm. Pressure foot lift: 9.5mm by knee lifter. Needle bar stroke: 30.5mm
ETL-27	High speed 1-needle, lockstitch m/c with built	1 set	Sewing speed: Upto 4,800spm. Stitch length: Max. 4mm. Needle bar stroke: 30.5mm
ETL-28	Zig-zag lock stitch sewing m/c for middle or heavy-fabric type	1 set	Sewing speed: 4,500spm. Pressure lifter: 10mm
ETL-29	Lock stitch sewing m/c single needles, 3-threads	1 set	Sewing speed: 8,500spm. Stitch length: 4mm Differential feed ratio: Stretching Max. 1.0:6 Pressure lifting amount: Gathering Max. 1:4
ETL-30	Hemming m/c	1 set	Sewing speed: 2,500spm. Stitch length: 3mm - 8mm
ETL-31	Bar tucking m/c 15-20 mm length	1 set	For knitted fabric. Tack size: 12mm width
ETL-32	Sewing m/c with compound feed motion, twin-needle, needle feed lock-stitch	1 set	Sewing speed: 3,500spm., Needle bar stroke: 33mm Pressure bar lift: 7mm
ETL-33	Standard body snap	1 set	Standard medium size
ETL-34	Flat seamer m/c 3-needle feed off the arm double chain stitcher	1 set	Sewing speed: 3,600spm., Needle bar stroke: 33.3mm Max. Stitch length: 1.5 - 4.0mm
ETL-35	Wrappers Workroom stand	1 set	Ladies: Size 10-12-14. Mens: Small/Med./Large Children: Chest 61cm, up to 8 yr

TABLE 4.4.2

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ITEM NO.	EQUIPMENT NAME	Q'ty	DESCRIPTION
ETL-36	Implements	1 set	
ETL-37	High speed, flat bed, 2-needle, double chain stitch	1 set	Sewing speed: 660spm. Stitch length: 1.4 - 4.0mm. Pressure foot lift: 5.5 - 10.0mm. Looper system: Rocking type looper
ETL-38	Texography material saving system	1 set	Mini Patter lay plan and photo copy Instrument. Automatic Printer
ETL-39	Programmable sewing m/c	1 set	Sewing speed: 5,000spm. for medium weight materials. Stitch length: 4.0mm. Needle bar stroke: 30.5mm
ETL-40	Multiple needles	1 set	Sewing speed: 4,500spm., Stitch length: 10-14 per inch
ETL-41	Needle positioner	1 set	Max. speed: 5,000spm. Max. stitch length: 14/inch
ETL-44	Profile stitching unit & jig	1 set	Standard lock stitch m/c and jigs
ETL-46	Needle heating monitor	1 set	Sensor: IR Sensor
ETL-47	Sewing thread consumption calculator	1 set	Measuring range: 10cm length (on fabric)
ETL-48	Fabric examination table	1 set	45" - 60" width. Table size: 72"
ETL-49	Pressing equipment	1 set	Steam press: 10kg/cm <sup>2</sup>

TABLE 4.4.2

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<u>LIST OF EQUIPMENT</u>			
FACULTY OF ENGINEERING DEPARTMENT OF TEXTILE TECHNOLOGY Spinning Laboratory			
ITEM NO.	EQUIPMENT NAME	Q'ty	DESCRIPTION
ETS- 1	Miniature card shirley type count range (Ne30-60)-for cotton	1 ea.	Cylinder speed: 800rpm. Doffer speed: 10rpm Card clothing: Metallic
ETS- 2	Miniature draw frame shirley type count range (Ne 30-60)-for cotton	1 ea.	Staple range: 24mm - 32mm. Draft range: 3.5 - 12.1 Front roller speed: 200rpm
ETS- 3	Miniature ring frame shirley type count range (Ne 30-60)-for cotton	1 ea.	Spindles per frame: 08. Gauge: 76.2mm Lift: 152.4mm
ETS- 4	High speed card with spares & accessories flat type for cotton & pre & even feeder	1 ea.	Working width: 1,016mm. Dia of cylinder: 1284mm. Dia to doffer: 697mm
ETS- 5	Drawing frame for cotton	1 ea.	Delivery speed: up to 400m/min.. No. of delivery: 02. Doubling: 8
ETS- 8	Fly frame (12-24 spindles)-for cotton	1 ea.	Gauze: 110mm (Spindle pitch). Lift: 406mm. Bobbin diameter: 152mm (Full)
ETS- 9	Ring frame (24 spindles)-for cotton (or 48 " " )- " "	1 ea.	Raw material: Cotton & blends (cotton/Synthetic) Spindle gauge: 70mm. Ring dia.: 38mm
ETS-10	Auto cone winder with compressor	1 ea.	Number of drums: 6.8 or 10 Yarn: Cotton, Synthetic/Natural Count range: 5 - 120 Ne
ETS-11	Doubler winder with spares	1 ea.	No. of drums: 24 or less. Doubling: up to 4 yarns Package: Cheese, 3.30° Cone
ETS-12	Two for one twister with control device (24 spindles)	1 ea.	Yarn applicable: 10/2-100/2 Ne (Cotton; Synthetic cotton) Traverse length: 152mm (take up package)
ETS-13	Open end spinner	1 ea.	Fiber length, denier: 6-30 Ne (Yarn Count range) Size of feed can: 14"x36"
ETS-14	Automatic cone winder (Mach Mini)	1 ea.	No. of winding drums: 01 Traverse length: 5" cheese, 6" cone Dia. of package: 35-100 mm (cheese) 50-100 mm (cone)
ETS-15	Fancy yarn spinner	1 ea.	No. of spindles: 04 Spindle rpm: up to 6000rpm



TABLE 4.4.2

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LIST OF EQUIPMENT

FACULTY OF ENGINEERING  
DEPARTMENT OF TEXTILE TECHNOLOGY  
Knitting Laboratory

ITEM NO.	EQUIPMENT NAME	Q'ty	DESCRIPTION
ETN- 1	Deluxe type semi full fashion flat knitting machine	1 set	Type: 1 - Single cam. Gauge 7. Knitting width: 40" or 52". Knitting speed: 55" courses per minute
ETN- 3	Single bed hand flat knitting machine	1 set	Number of needles: 7 per inch. Row counter: Built-in. Needle pitch: 3.6mm
ETN- 4	Double bed hand flat knitting machine	1 set	Number of needles: 250 needles. Needle pitch: 5 gauge preferred or 7
ETN- 5	Circular weft knitting m/c (Interlock)	1 set	Number of feeders: 24. Gauge: 16 - 18

TABLE 4.4.2

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<u>LIST OF EQUIPMENT</u>			
FACULTY OF ENGINEERING DEPARTMENT OF TEXTILE TECHNOLOGY Weaving Laboratory			
ITEM NO.	EQUIPMENT NAME	Q'ty	DESCRIPTION
ETW- 1	Auto pirnwinder	1 set	Pirn feeding system; Automatic (Multicell Pirn Battery) Driving system: 3-step pulley by V belt drive
ETW- 5	Drawing in m/c	1 set	Usable reed: Single reed, with up to 60 dents/inch Denting speed: 90 dents/min. (max.) Working width: 65" (max.)
ETW- 6	Rapier loom with spares & tools	1 set	Reed space: 140c.m. Weft insertion: Double band rapier (centre transfer) Flexible rapier. Harness motion: Dobby (Staubli positive type)
ETW- 7	Dobby-20 shafts, for rapier loom and punching m/c for dobbie	1 No.	
ETW- 8	Air-jet loom with bobbin winder + spares  Air compressor with air-dryer, air receiver, mist separator & spare parts	1 set	Dobby shedding of 16-20 shafts. Reed speed: 150cm. Weft insertion system: Air-jet
ETW-19	Air compressor	1 set	Rated pressure: 9.5kg/cm <sup>2</sup> .G. Free air delivery: 440L/min. Air tank capacity: 125L
ETW-20	Water jet loom	1 set	Reed space: 150-190cm Harness motion: Plain shedding-6 shafts Weft insertion: Water-jet

TABLE 4.4.2

(23)

COMMON FACILITY  
ENGINEERING LIBRARYLIST OF EQUIPMENT

ITEM NO.	EQUIPMENT NAME	QUANTITY	SPECIFICATION
CL- 1	Book stock shelving (2 kinds)	10 ea.	1600h X 1830w X 520D mm. (Approx.) Material: steel 1920h X 1830w X 500Dmm. (Approx.) Material: steel
CL- 2	Compact mobile shelving system	1 ea.	2434mm(H) X 370 (D) X 6415 (W) (7 series)
CL- 3	Work room shelving to accommodate 10,000 volumes (2 kinds)	11 ea. 22 ea.	84" (H) x 38" (W) x 9" (D) (Approx.) Material: steel 84" (H) x 38" (W) x 9" (D) (Approx.) Material: steel
CL- 4	Journal display & storage	60 ea.	6' 3" (H) x 3' (W) x 1' (D) - Display 10' (H) x 3' (W) x 1'7" (D) - Storage Material: Metal
CL- 5	Storage cabinets for vertical filing of maps	5 ea.	Medium Cabinets Drawer Size 2 1/8" (H) x 43 1/2" (W) x 32" (D)F (Approx.) Five drawer cabinet
CL- 6	Atlas stands	1 ea.	40 3/4" (H) front, 43 1/4" at the back, 30 3/4" Wx25", deep 6 shelves Material: Steel
CL- 7	Dictionary stands	5 ea.	44" (H) x 24" (W) x 14" (D) 2 shelves Material: Steel
CL- 8	Storage systems for microfilm & A-V materials	5 ea.	410(W) X 665(D) X 740(H) m.m. Material: Steel No. of drawer: 4 pcs.
CL- 9	Open study carrels (single and add on) for 200 readers		
	Type I	40 ea.	48"(H) X 36"(W) X 24"(D), Single face
	Type II	40 ea.	48"(H) X 36"(W) X 24"(D), Single face
CL-10	Charging desks	1 ea.	850(H) X 900(W) X 600(D)
CL-11	Book trucks	20 ea.	32"(W) x 37 3"(H) (Approx.) X 12"(D) Material: Steel
CL-12	Card catalogue cabinets	2 ea.	Material: Steel 60"(H) x 40 3/4"(W) x 17 1/2 (D)
CL-13	Equipment for mounting displays of books and other exhibits	1 set	935(W) X 599(D) X 1,908(H)
CL-14	Microfilm reader	1 ea.	Magnification: x7 - x46. Copy speed: 4 copies/min. Print system: Positive prints from both negative and positive film.
CL-15	Microfilm processor	1 ea.	Film: 16mm negative roll microfilm, 30.5m Reduction ratios: 25x Original size: 297x420m.m. (A3 size) Exposure control: Dial and Seal
CL-16	Equipment for a library bindery	1 ea.	Binding speed: 30 seconds for Perforation & Binding Binding thickness: 1m.m. to 50m.m.

TABLE 4.4.2

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<u>LIST OF EQUIPMENT</u>			
COMMON FACILITY PHYSICAL EDUCATION			
ITEM NO.	EQUIPMENT NAME	Q'ty	DESCRIPTION
CP- 1	Parallel bars	1 set	Length: 3.5m Adjustable between 1.4m and 1.8m
CP- 2	Vaulting box (adjustable)	1 set	8 steps, Rubber floor guards
CP- 3	Sculling exercise machine	1 set	For whole body power. L=1,400, W=1,650
CP- 7	Weighing machine - platform type	1 set	Max. weighing: 100kg Accuracy: every 100gr.
CP- 8	Marine training boat		
	i. 4 persons + 1 coach	1 set	
	ii. 2 persons + 1 coach	1 set	Standard competition type
	iii. 1 person + (single scull)	1 set	Material; Fiber glass/wood
	iv. Olympic standard weight lifting set	1 set	Barbell. Bar; 1.55m(L). Gross section; 28mm

TABLE 4.4.2

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<u>LIST OF EQUIPMENT</u>			
COMMON FACILITY LANGUAGE LABORATORY			
ITEM NO.	EQUIPMENT NAME	Q'ty	DESCRIPTION
*LL-1	Language laboratory with 24 components units	1 set	
*LL-1-1	Control console	1 set	Headset microphone 25 ohms - 75dB Headset earphone 8 ohms - 19 dB 609 x 156 x 288 mm
*LL-1-2	Remote control unit	1 set	
*LL-1-3	Open reel master	1 set	2 Track, 2 channel stereo. Tape speed; 9.0cm/sec 378 x 402 x 236 mm
*LL-1-4	Master cassette recorder	2 sets	4 Track 2 channel. 240 x 120 x 147 mm
*LL-1-5	Remote control unit	1 set	174 x 40 x 129.5 mm
*LL-1-6	Remote control unit	2 sets	174 x 68 x 75.5 mm
*LL-1-7	Headset	1 set	Sensitivity; -91dB. Frequency Response; 20-18000 Hz
*LL-1-8	Speaker	2 sets	280 x 500 x 260mm
*LL-1-9	Console desk	1 set	Control Console desk for LLC-8A Teacher's control console. 1,200 x 730 x 850mm
*LL-1-10	Upper panel	1 set	
*LL-1-11	Side panel	2 sets	
*LL-1-12	console desk	2 sets	To house master tape recorders turn tables etc.600 x 730 x 800mm
*LL-1-13	Student cassette deck	27 sets	4 Track, 2 channel. Tape speed; 4.8cm/sec 212 x 135 x 282mm
*LL-1-14	Headset for student	27 sets	Sensitivity; -90dB, Frequency Response; 30-15000Hz
*LL-1-15	Twin booth	14 sets	
*LL-1-16	Cable A	4 rolls	7 pole cable
*LL-1-17	Cable B	4 rolls	5 pole cable
*LL-1-18	Installation materials	1 set	
*LL-1-19	Student cassette deck	2 sets	237 x 48 x 168mm
*LL-1-20	Headset for student	4 sets	
*LL-1-21	Audio cassette	50 ea.	
*LL-1-22	Dynamic microphone	1 set	Frequency Response; 80-13000Hz Output Impedance; 250 ohms. 21.5 (Dia.)x165(L)
*LL-1-23	Microphone holder	1 set	
*LL-1-24	Table stand for microphone	1 set	Screw; 5/16" thread, and 1/2" pipe thread 80 x 110 x 39mm

TABLE 4.4.2

(26)

ITEM NO.	EQUIPMENT NAME	Q'ty	DESCRIPTION
*LL-1-25	Audio stereo amplifier	1 set	430 x 105 x 280mm. 270V, 50Hz
*LL-1-26	High fidelity turntable	1 set	430 x 100 x 425mm. 240V, 50Hz
*LL-1-27	Console desk	1 set	To house amplifiers & turn tables. 600 x 730 x 800mm
*LL-2	Video for language laboratory system and others	1 set	
*LL-2-1	Colour camera	1 set	3 tube colour Video Camera
*LL-2-2	Colour video monitor	1 set	
*LL-2-3	Video cassette recorder	1 set	
*LL-2-4	Remote controller for basic function	1 set	212 x 87 x 38mm
*LL-2-5	Studio/Video selector	1 set	440 x 44 x 170mm
*LL-2-6	Desk	2 sets	730 x 500 x 650mm
*LL-2-7	Console	1 set	
*LL-2-8	Cable	1 set	
*LL-2-9	Open reel audio tape	50 ea.	
*LL-2-10	Video cassette tape 60	50 ea.	KCA-60 Type
*LL-2-11	Video cassette tape 30	50 ea.	
*LL-2-12	Bulk eraser for cassettes	1 ea.	
*LL-2-13	Tape recorder cleaning kit	1 set	
*LL-2-14	Rechargeable battery pack	4 ea.	Voltage DC 12V, Capacity -3hrs
*LL-2-15	Battery charger	1 set	AC240V, 50Hz, 50W
GT- 7	TV projection system	1 set	Video projector; 100" universal 4-colour system. Flat screen 100" roof type

NOTE : \* shows equipment which is part of a language laboratory system.

## **CHAPTER 5 PROJECT IMPLEMENTATION SCHEME**





## CHAPTER 5 PROJECT IMPLEMENTATION SCHEME

### 5.1 Work Execution Plan

After the conclusion of Exchange of Notes between the Governments of both countries; a series of discussions shall be made in detail between the University of Moratuwa and a Japanese consulting firm with regard to the detailed design, preparation of tender documents, purchasing methodology of equipment, and installation work at site based on the engineering philosophy embodied in the Basic Design Study. The implementation practice and schedule should be well planned to complete the Project within the period designated in the Exchange of Notes with such elemental factors taken into consideration as equipment manufacturing period, schedule and scope of work of the Sri Lanka side, required time from shipping date to site delivery, etc.

### 5.2 Scope of Implementation and Responsibility

The work to be undertaken by the Japanese side is composed of the following:

- (1) Provision of educational equipment
- (2) Ocean transportation
- (3) Inland transportation
- (4) Installation of equipment
- (5) Assembly work of power and water line in laboratories
- (6) Performance tests and supervisory work for major equipment
- (7) Overall consultation work for detailed design, tendering and supervisory work for the above at implementing stage

The work to be undertaken by the Sri Lanka side is as follows:

- (1) To secure the space and prepare the foundations for installation of equipment
- (2) To provide the power and water outlets at locations near the equipment, if needed
- (3) To undertake incidental civil and utility-related works for expansion and reconstruction of laboratories, increase of electric power capacity, etc., if needed
- (4) To ensure unloading and customs clearance at the port of disembarkation
- (5) To exempt Japanese nationals from various internal taxes in Sri Lanka and take tax-exempt measures for equipment import
- (6) To provide the temporary office with general furniture for the administrative work of Japanese side

### 5.3 Executing Organization and Management System

The University of Moratuwa will be the executing organization of the Project under the supervision of the Ministry of Higher Education.

Task Force Team is to be organized in the University of Moratuwa to successfully implement the Project. A typical organization is planned as shown in Figure 5.3.1.

#### (1) Project Representative

The Person nominated as the representative of this Project by the Government of Sri Lanka will arrange and coordinate the all required work of the Sri Lanka side under his responsibility.

(2) Department's Counterparts

The experienced personnel of each department will participate in the team to undertake their roles and duties in respect to the detailed work, i.e, design, manufacture, inspection and installation. They will also contemplate and arrange the methods of technology transfer to the University.

(3) Safety

The personnel in charge of Safety Division will take the necessary measures to prevent the equipment from losses and damages and also to ensure safety of the workers.

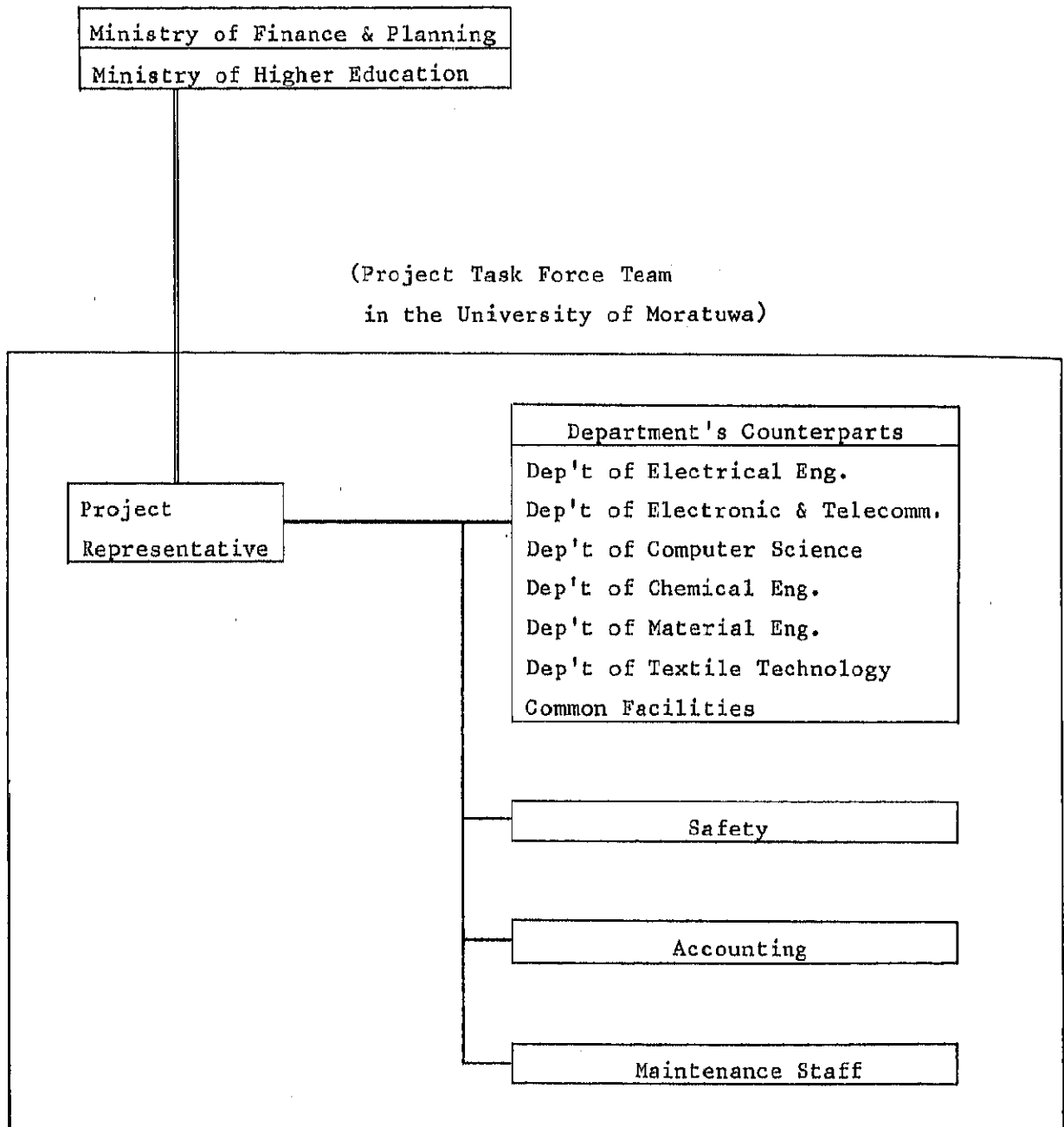
(4) Accounting

Accounting staff will be in the Team to control the budget of the Sri Lanka side and to manage the storekeeping.

(5) Maintenance Staff

It is recommended that the Team involves some members who will be in charge of future maintenance work.

Figure 5.3.1 Organization During Implementation Stage



#### 5.4 Project Costs

The project costs shared by Sri Lanka side are estimated at Rs. 2,400 thousand (10,980 thousand yen) which is composed of the following external expenses.

##### Project Costs Shared by Sri Lanka Side

Site Arrangement Costs:	Rs. 2,100,000
Other Expenses :	Rs. 300,000
<hr/>	
Total	Rs. 2,400,000

##### (1) Site Arrangement Costs

As the site arrangement costs, the total of worker expenses, lease of construction machineries and the costs of construction materials is estimated at Rs. 2,100 thousand, which is required for the preparation of foundations and structures, the arrangements of power and water outlets and replacement of a power transformer and cables for the building of the Department of Electrical Engineering, Electronic & Telecommunication and Computer Science.

##### (2) Other Expenses

In the implementation stage of the Project, some miscellaneous expenses are required for communication, travelling, and purchase of office supplies, etc. Such costs are estimated at Rs. 300 thousand, considering the experience of similar recent projects.

#### 5.5 Execution Schedule

Execution schedule (draft) is shown in Table 5.4.1. This indicates that the Project will be carried out according to the following major procedures.

After the conclusion of the Exchange of Notes between the Governments of Sri Lanka and Japan within the framework of the scope of this Exchange of Notes, a consulting contract shall be concluded between the Government of Sri Lanka and a Japanese consulting company to proceed with the concrete detailed design.

The consulting firm shall prepare the equipment specifications, drawings and other documents required for tendering of the Project. After completely establishing the Tender Documents, with approval thereof by Sri Lanka side, the tender will be called.

The successful bidder shall, after signing the Agreement with the Government of Sri Lanka, get started on such tasks as equipment procurement, manufacture, delivery to the site and installation work after due authorization by the Japanese Government to complete the Project by the stipulated date in the Agreement.

During the installation period, the consulting firm will dispatch its engineer(s) to supervise and effectuate the construction management and will transfer the equipment to the Sri Lanka side by the contracted date. This Project will complete on transferring all the equipment to the Sri Lanka side.

Table 5.5.1 Project Execution Schedule (Draft)

Item	Months after Conclusion of Exchange of Notes												
	0	1	2	3	4	5	6	7	8	9	10	11	12
Conclusion of Exchange of Notes	▼												
Consultant Contract		■											
Confirmation of Equipment Specifications, Tendering Conditions		■											
Preparation of Tender Documents		■											
Tendering			■										
Tender Evaluation, Contract with Implementing Firm				■									
Design, Manufacture					■	■	■	■	■	■	■		
Shop Inspection, Packing and Shipping							■	■	■	■			
Custom Clearance and Inland Transportation								■	■	■			
Delivery, Installation and Commissioning									■	■	■	■	
Certificates of Acceptance											■	■	





**CHAPTER 6   MANAGERIAL PLAN FOR  
MAINTENANCE OF EQUIPMENT**



## CHAPTER 6 MANAGERIAL PLAN FOR MAINTENANCE OF EQUIPMENT

### 6.1 Maintenance System

The University of Moratuwa conducts maintenance of the educational equipment under the following system.

#### 6.1.1 Administration and Supplies Procurement

The fixed assets of the University including the laboratory equipment is statutorily in the custody of the Registrar. The inventories are maintained by each head of department and are subject to Annual Boards of survey carried out by committees appointed by the Vice Chancellor.

The stock-keepers manage the central stores wherein stock controls and stock issues are administrated. New orders are also placed by the central stores except in the case of purchases requested by the heads of departments.

All purchases to be made locally are requested by the heads of departments. The purchase of foreign products needs the approval of the tender board appointed by the Vice Chancellor. Requests for the purchases above a certain budget limit are referred to the above board.

All goods delivered are first entered at the central stores and later transported to the inventory of the relevant department of study.

#### 6.1.2 Maintenance and Repairs of Equipment

The maintenance and repairs of the laboratory equipment is undertaken on two regular basis in the following ways:

- (1) By the technicians of the departments of study
- (2) By the vender according to an annual service agreement

The technicians perform the maintenance work in line with the manuals and instructions supplied by vendors, using the spare parts stocked in the department or central stores. In case where the equipment is under manufacturers warranty, the University usually enters into maintenance service agreement with the vendor or supplier to provide maintenance work.

Each department of study has one or more technicians who have acquired some specialized and/or general purpose training locally or overseas. These technicians can accommodate the maintenance work with the back-up assistance of the two workshops. One is the electronics workshop allocated in the Department of Electronic & Telecommunication Engineering. The other is the mechanical engineering workshop in the Department of Mechanical Engineering wherein several types of skilled labour are available. The capability and experience of the local vendors are usually adequate for the regular maintenance of the equipment.

The calibration of equipment as per standards is either done in the University or at the Ceylon Institute for Scientific Research or the Ceylon Standards Bureau.

## 6.2 Managerial Plan for the Maintenance

As for the maintenance of the equipment newly supplied under the Project, it is recommended to perform the maintenance according to the following system and procedures:

### (1) Maintenance Organization

The University will utilize the full organizational system it now has for the administration and maintenance of the equipment. In addition, it is recommended that the University establishes a special Task Force for the Project's equipment, comprising the electronics and mechanical workshop engineers, the staff technicians and a select group of other technicians. They will be directly responsible to the Dean of Faculty of Engineering. The supplies officer will also be associated along with the finance division for budgetary purposes.

(2) Spare Parts Procurements

The spare parts are to be ordered as per manuals and instructions in terms of part number, maker and model number, etc. The procurement will be done on a general stock basis or essential-order basis. In the former, regular procurement is done by the department through the central stores. In the latter, each department of study places the orders through the central stores.

(3) Computer Science Workshop

It is proposed to develop a similar workshop in the Department of Computer Science & Engineering to accommodate the maintenance and to train its technicians.

(4) Training of Technicians

The level of training and experience of the technicians varies between each employee and department. The average, however, is sufficient for the specialized training to be imparted, where necessary. It is proposed that the technologies of maintenance and repairs will be transferred to them through the supervisory work done by vendors.

### 6.3 Budget for Annual Maintenance

#### 6.3.1 Fund

The budget available for maintenance of laboratory equipment is provided through the Government Grant and also through other income earned directly by the University. The Government has incorporated Rs. 36 to 40 million in the annual budget for maintenance; this will be allocated among all universities in Sri Lanka. The direct annual earnings of the University currently amounts to approximately Rs. 750,000 in local currency and US\$ 20,000 under foreign aid programs.

The University can accommodate the maintenance of the equipment utilizing the essential spare parts delivered as a part of initial supply. Thereafter, the University will procure and store spare parts as per

manuals and instructions or through utilizing the experience of use. The funds for maintenance will be sought and provided in the University's annual estimates in the relevant year. The Ministry of Higher Education presented its opinion that the special budget allocation would be considered for this Project to satisfy the requirements of the maintenance.

### 6.3.2 Estimation of Annual Maintenance Costs

Maintenance costs vary depending on the frequency of equipment use and the conditions of daily repairs. The annual costs, however, are preliminarily estimated as current Rs. 4,200 thousand. The above budgetary figure is composed of the external payments for procurement costs of spare parts and the expatriate maintenance service costs for mini-computer and engineering work station. The personnel expenses and the costs to use workshop are not estimated since these are considered as internal expenses.

#### (1) Spare Parts Costs

Spare parts costs are estimated at about 16.0 million yen (Rs. 3,500 thousand) comprising the following standard rates on a capital value basis.

<u>Equipment of:</u>	<u>Spare Parts Cost (% on Capital Value)</u>
Electrical Engineering	2.0%
Electronic & Telecommunication	2.5%
Computer Science	1.0%
Chemical Engineering	3.0%
Materials Engineering	2.0%
Mathematics	1.0%
Textile Technology	2.5%
Common Facilities	1.0%

#### (2) Expatriate Maintenance Service of Computer System

It is necessary to receive maintenance service of computer systems

on either the Service Agreement or Per Call basis. The cost is assumed about 3.2 million yen (Rs. 700 thousand) per year on a Per Call costs. The cost on a Service Agreement basis depends on the contract condition and varies from a few percent to around 10 percent on a capital value.

### 6.3.3 Implementation of Maintenance

The provision by the Project of educational equipment to the University of Moratuwa will put an additional burden of maintenance cost on the University. As stated in 6.3.1 the Ministry of Higher Education will make special provisions for this incremental maintenance cost, which will enable the equipment to be properly maintained.





## **CHAPTER 7 APPRAISAL OF THE PROJECT**



## CHAPTER 7 APPRAISAL OF THE PROJECT

### 7.1 Socio-Economic Benefits

The implementation of the Project will greatly improve the quality of education and research in the University of Moratuwa in a short time. The positive and favorable effect of the improvement of education will be pronounced in Sri Lanka society and industry as more graduates educated under an improved educational environment work for the society and industry and contribute to the economic growth and social welfare of Sri Lanka.

#### (1) Improvement of Education and Research

- 1) Provision of the educational equipment enables the University to conduct the education and research in line with the curricula which are not presently possible for lack of needed equipment, and also to newly introduce curricula which had previously not been possible for lack of educational equipment. The quality of education and research will be effectively improved and the scale will be expanded by the receipt of new equipment.
- 2) Given the present situation of increasing student numbers, the provision of the equipment will contribute to the effective education and research.
- 3) The improvement of education realizes the potential of the society and industry of Sri Lanka by producing graduates who have good command of theory and practice.

#### (2) Secondary Effects to Society and Industry

Various benefits will be brought to the society and industry by the increase of the graduates of the University. Such secondary effects are as follows.

- 1) Technology advancement in industry
- 2) Improvement of productive efficiency
- 3) Advancement of capability for innovation and development in various industrial fields
- 4) Saving and increase of foreign currency income by the production of import substitutes

These benefits may be expected as secondary effects produced by the realization of the Project. Explained below is how the Project will produce such social benefits.

- 1) The improvement of educational equipment in the Department of Electrical Engineering will enable the students to be better educated and trained in theory, reinforced by practice. The electrical engineering graduates will be able to help and facilitate the efficient implementation of the development of power generation and distribution in which Sri Lanka takes a great interest. The education in the curricula of high voltage engineering, manipulation of electric equipment, use and application of power semiconductors will be practically applied to such development projects.
- 2) New installation and renovation of the telecommunication system is one of the important plans in the Development Programme of Sri Lanka. By the improvement of educational equipment of the Department of Electronic & Telecommunication Engineering, the graduate engineers will contribute to the smooth promotion and efficient operation of the telecommunication system. Particularly, the good educational effects in microwave communication, optical communication, computerized numerical control will be effectively utilized in the modernization of Sri Lanka.
- 3) The improvement in the Department of Computer Science & Engineering will promptly familiarize the students with computer network systems and graphic and image processing

much needed by the industries of Sri Lanka. Another effect is to educate and produce graduates who can use machinery with built-in computers. The increase of computer engineers will contribute to the technological development and enhancement of productivity of the industries of Sri Lanka.

- 4) By the receipt of CNC (Computer Numerical Control) lathe and CNC machining center, it becomes possible to educate and train the students for the technology and practice of these machineries which are utilized in die manufacturing, and other precision industries. This will help Sri Lanka design and produce its own original products.
- 5) The introduction of new equipment in the Department of Chemical Engineering will help the students develop a good understanding of the abstract and complicated theories such as thermodynamics, chemical reaction engineering, etc. through the practical education. The technology advancement in the Polymer Technology Division of the Department will contribute to the industries of plastics and rubber production.
- 6) Provision of the new equipment in the Department of Materials Engineering enables such researches on microscopic level as studies on molecular structure of plastics, mineral resources, etc. which are important to Sri Lanka. If such a practice spreads to the industry of Sri Lanka, the quality of industrial products would greatly improve.
- 7) Micro-computers will be installed in the Department of Mathematics to facilitate education and training of the students of other departments other than Department of Computer Science & Engineering. The basic knowledge for the operation of a computer is indispensable to every engineering student. Easy access to computers and availability of engineers capable of using computers have a significant meaning in view of the contribution to the industry of Sri Lanka.

- 8) Textile industry has shown a very rapid growth in recent years. By the effective utilization of the equipment and machineries supplied by the Project, it is expected that the University will produce graduates equipped with adequate knowledge and experience in all range of textile processings from spinning, knitting, colouring, etc. The supply of qualified graduates could promote the replacements of the many expatriate engineers and administrators currently engaged in textile industry with Sri Lanka nationals. The implementation of this Project will have an immediate effect on the economy and the growth of the textile industry of Sri Lanka.
  
- 9) The equipment in Common Facilities will be utilized as basic supporting equipment for education. Language laboratory equipment being supplied will help improve the ability of the students to use English which has been deteriorating so much recently that some students can not completely follow lectures given in English.
  
- 10) The advancement of domestic technology in the industries of petrochemicals, plastics, etc. will contribute to reducing the drain on foreign currencies by substituting their products for the commodities now imported. The export-oriented industries like textiles, garments, and petroleum products will be further promoted by the technology advancement.
  
- 11) Foreign currency accumulation is also expected by the replacement of expatriate workers with Sri Lanka nationals.
  
- (3) There are only two educational institutions in Sri Lanka giving higher technical education: the University of Peradeniya and the University of Moratuwa. The latter is a professional technical education institute. The contribution of this Project in the improvement of technical education of Sri Lanka should be highly evaluated because the beneficiary is the only pure technical university in Sri Lanka.

## 7.2 Notes on Project Implementation

- (1) In the implementation of the Project, no serious problems are expected that could interfere with smooth execution of work such as the removal and reconstruction of cement walls or floors, or extension of the supply network of water or electricity. Therefore this Project is very efficient in terms of money and time.
- (2) The University of Moratuwa utilizes to the fullest capacity the organizational system it now has for the maintenance and repairs of the existing facilities and equipment. As for the equipment to be introduced during the Project, the University has a concrete plan to form a task force team to perform the maintenance and repairs effectively. Provided that sufficient budget for annual maintenance can be secured by the Ministry of Higher Education, the equipment supplied in the Project will be kept in good condition and the equipment will contribute to the improvement of education in the University.
- (3) This Project will contribute to betterment of the understanding of the Sri Lankan students about modern Japanese technology by providing a great number of varied educational equipment. Friendly relations between Sri Lanka, which historically has tended to look to the English-speaking countries, and Japan, will be further strengthened.





**CHAPTER 8 CONCLUSION AND  
RECOMMENDATIONS**



## CHAPTER 8 CONCLUSION AND RECOMMENDATIONS

### 8.1 Conclusion

The Government of Sri Lanka has been making a sincere effort to develop human resources in the field of science and technology along with the policy to intensify social and economic development. The improvement and intensification of the educational equipment for the University of Moratuwa, the only university for the sole purpose of technical and engineering research and education, will enable the University to improve the quality of education and research as well as to accept an increasing number of students and give them better and effective training.

The effect of the implementation of this Project on education will be very great, with substantial contributions being made to the development of qualified engineers and eventually to the solidification of the social and economic structures of Sri Lanka. Therefore, the execution of this Grant Aid Project is very meaningful and is expected to give a very positive effect.

### 8.2 Recommendations

The work should be done efficiently and effectively in order to complete all required work within the given budget and schedule. The Sri Lankan side, for these reasons, is requested to prepare the necessary funds for the Sri Lanka side costs, to arrange executing organization and to complete the site preparation work within a scheduled period.

In order to best utilize the educational equipment selected and provided by this basic design study, the Sri Lankan side is recommended to take the following measures:

- (1) Ministry of Higher Education secures the necessary funds for spare parts, repair and maintenance in annual budget of the University of Moratuwa.

- (2) The University of Moratuwa establishes a special task force for maintenance of the equipment to be provided. Technical training should be undertaken to maintain the equipment during installation; the future maintenance work should also be considered.
- (3) The University of Moratuwa further reviews the curriculum and experimental plans to make them better match the newly provided equipment and prepare manuals for students on how to conduct experiments with the equipment in accordance with the curricula and experimental plans.
- (4) The University of Moratuwa places emphasis on developing engineers able to cope with the needs of industry and society. The University of Moratuwa will raise the technical level of the teaching staff even further with the equipment introduced through well-equipped curricula and experimental plans.

## **APPENDICES**



## APPENDICES

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**MINUTES OF DISCUSSIONS**  
**ON**  
**THE PROJECT FOR PROVISION OF EDUCATIONAL EQUIPMENT**  
**FOR**  
**THE UNIVERSITY OF MORATUWA**  
**IN**  
**THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA**

In response to the request of the Government of the Democratic Socialist Republic of Sri Lanka, the Government of Japan decided to conduct a basic design study on the project for Provision of Educational Equipment for the University of Moratuwa (hereinafter referred to as "the Project"), and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to Sri Lanka the study team headed by Dr. Akira Shinohara, Dean, Faculty of Textile Science and Technology of Shinshu University from December 5 to December 25, 1987.

The Team had a series of discussions on the Project with the officials concerned of the Government of Sri Lanka headed by Dr. F.S.C.P. Kalpage, Secretary, Ministry of Higher Education & Chairman, University Grants Commission and conducted a field survey in Colombo and Moratuwa.

As a result of the study and discussions, both parties agreed to recommend to their respective Governments that the major points of understanding reached between them, attached herewith, should be examined toward the realization of the Project.

Colombo, December 12, 1987.

*Willie Mendis*

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12.11.87  
Professor Willie Mendis  
Vice-Chancellor  
University of Moratuwa

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待字可也

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Dr. Akira Shinohara  
Leader  
Basic Design Team  
Japan International  
Cooperation Agency

*F.S.C.P. Kalpage*  
-----  
Dr. F.S.C.P. Kalpage  
Secretary Ministry of Higher Education  
Chairman, University Grants Commission

1. **TITLE OF THE PROJECT**

The title of the Project is "Project for Provision of Educational Equipment for the University of Moratuwa in the Democratic Socialist Republic of Sri Lanka".

2. **OBJECTIVES OF THE PROJECT**

The objectives of the Project are to provide necessary equipment for the improvement of educational equipment for the University of Moratuwa in order :

- 1) to enhance the quality of training of undergraduate students
- 2) to provide facilities which would enable the training of an increased number of students
- 3) to strengthen facilities for research and post-graduate teaching with a view to enhancing the University's current contribution to national development.

3. **IMPLEMENTING AGENCY**

- 1) The Implementing Agency for the Project is the University of Moratuwa under the supervision of Ministry of Higher Education.
- 2) The number of teaching staff at the University of Moratuwa related to the Project is shown in ANNEX 1.

4. **PROJECT SITE**

The site of the Project is located at Katubedda within the Urban Council limits of Moratuwa, 17 km from Colombo as shown in ANNEX 2.

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5. **SUMMARY OF REQUESTED ITEMS FOR THE PROJECT**

The summary of the requested equipment is shown in the attached ANNEX 3 reflecting the priority of the requested equipment.

6. **GRANT AID PROGRAM**

- 1) The Sri Lanka side has understood the system of the Japan's Grant Aid Program explained by the Team which includes a principle for use of a Japanese consultant firm and Japanese contractors for the implementation of the Project.
- 2) The Sri Lanka side will undertake to ensure the necessary budget and personnel for the proper and effective operation and maintenance of equipment provided under the Grant Aid.
- 3) The Team will convey to the Government of Japan the desire of the Government of Sri Lanka that the former takes necessary measures to cooperate in implementing the Project and provide necessary equipment under the Japan's Grant Aid Program.

7. **NECESSARY MEASURES TAKEN BY SRI LANKA**

The Sri Lanka side understood that the necessary measures will be taken by the Sri Lanka side as shown in the attached ANNEX 4.

8. **FORWARD OF EQUIPMENT LIST**

The equipment request will be examined by the Team in Japan and the examined equipment list will be sent to the Sri Lanka side in the late of January, 1988 for confirmation of the list. Sri Lanka will forward the comment on the said List in the middle of February, 1988 through the JICA office, Sri Lanka.

9. FINAL REPORT

10 copies of the final report will be submitted to the Sri Lanka side at the end of April, 1988.

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**ANNEX 1 TEACHING STAFF**

<u>Department</u>	<u>HD</u>	<u>PR</u>	<u>AP</u>	<u>SL</u>	<u>LT</u>	<u>AL</u>	<u>TA</u>
Chemical Engineering & Polymer Technology	1	1	0	3	1	6	2
Computer Science & Engineering	1	0	0	1	0	3	0
Electrical Engineering Electrical Machine & Controlled Drives Power System & High Voltage Engineering	1	1	0	1	3	11	2
Electronics and Telecommunication Eng. Physics	1	1	0	1	0	18	2
Material Engineering	1	1	0	0	2	3	2
Mathematics	1	1	0	3	1	4	4
Textile Technology	1	1	0	0	3	2	1
Total	7	6	0	9	10	47	13

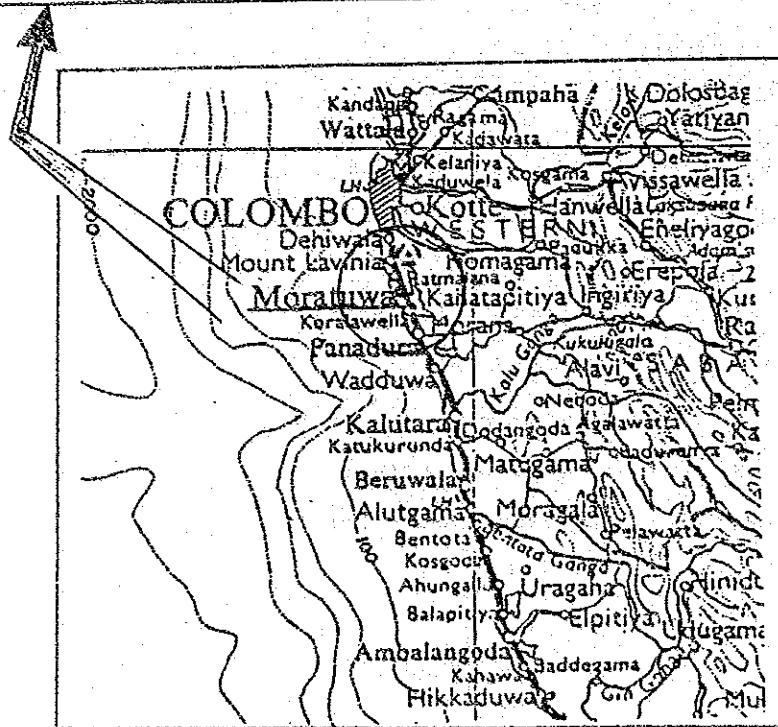
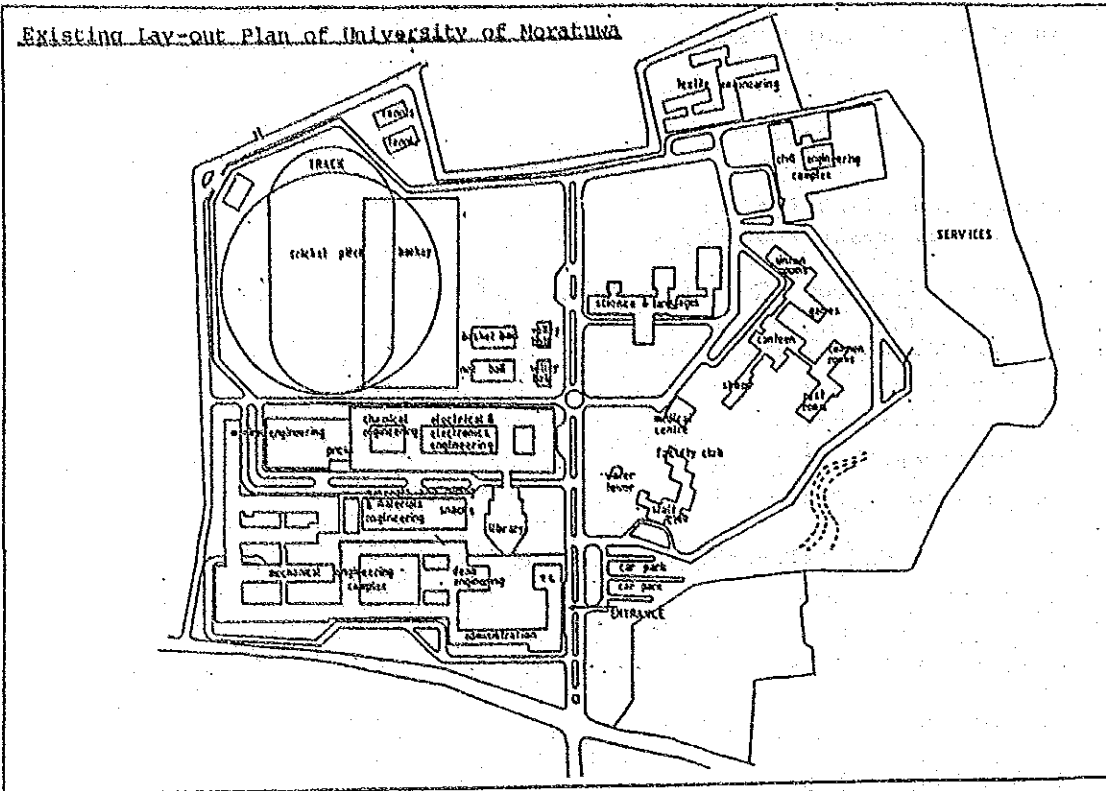
**Notes:**

HD	Head of Department
PR	Professor
AP	Assistant Professor
SL	Senior Lecturer
LT	Lecturer
AL	Assistant Lecturer
TA	Teaching Assistant

SK /

C.S.

ANNEX 2 PROJECT SITE



SK / AS

ANNEX 3 SUMMARY OF REQUESTED ITEMS

Department	Priority			N.R.I.
	A	B	C	
1. Electrical Engineering	28	24	-	-
2. Electronic & Telecommunication	50	66	9	8
3. Computer Science	12	57	-	-
4. Chemical Engineering	11	15	-	1
(Chemical Eng. Div.)	(7)	(8)	(-)	(1)
(Polymer Tech. Div.)	(4)	(7)	(-)	(-)
5. Material Engineering	3	4	-	-
6. Mathematics	2	-	-	-
7. Textile Technology	84	16	28	4
(Chemical Processing & Testing Lab)	(22)	(11)	(3)	(-)
(Clothing Lab)	(43)	(3)	(3)	(-)
(Elec. Machine)	(-)	(-)	(7)	(-)
(Spinning Lab)	(11)	(-)	(2)	(2)
(Knitting Lab)	(2)	(2)	(-)	(1)
(Wearing Lab)	(6)	(-)	(13)	(1)
8. Common Facility	53	11	22	-
(Eng. Library)	(8)	(8)	(11)	(-)
(Physical Education)	(2)	(3)	(5)	(-)
(Language Lab)	(42)	(-)	(-)	(-)
(Central Teaching Support)	(1)	(-)	(6)	(-)
<b>Total</b>	<b>243</b>	<b>193</b>	<b>58</b>	<b>11</b>

(Notes)

- Priority A : Items requested with the first priority  
 Priority B : Items requested with the second priority  
 Priority C : Items to be deleted from the original request  
 N.R.I. : Newly requested items due to revision

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**ANNEX 4 NECESSARY MEASURES TAKEN BY SRI LANKA SIDE**

1. To provide utilities and supporting facilities such as electricity, water, drainage, local telephone and other incidental facilities.
2. To ensure prompt unloading, tax exemption, customs clearance at port of disembarkation in Sri Lanka and prompt internal transportation therein of the products purchased under the Grant.
3. To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in Sri Lanka with respect to the supply of the products and services under the verified contracts.
4. 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 to Sri Lanka and stay therein for the performance of their work.
5. To maintain and use properly and effectively the equipment purchased under the Grant.
6. To undertake incidental civil and utility-related works for expansion/reconstruction of laboratory, increase of electric power capacity, etc., if needed.
7. To provide general furniture required for the administrative purpose in University except those for the training purposes.

SK /

P.S.



LIST OF ATTENDANTS  
IN THE MEETING

SRI LANKA SIDE :

Ministry of Higher Education

Dr. F.S.C.P. Kalpage  
Secretary, Chairman University Grants Commission

Mr. D.A. Samaraseera  
Senior Assistant Secretary

Mr. Nimal Samarasekera  
Senior Assistant Secretary

Miss D.F.C. Hanwella  
Accountant University Grants Commission

Department of External Resources, Ministry of Finance  
and Planning

Mr. Senarat Weerapana  
Assistant Director

The University of Moratuwa

Professor Willie Mendis  
Vice-Chancellor

Professor C.L.K. Tennakoon  
Dean/Engineering

Professor Sam Karunaratne  
Head/Electrical Engineering

Dr. (Mrs) I. Dayawansa  
Head/Electronic & Telecommunication Engineering

Dr. A.S. Induruwa  
Head/Computer Science & Engineering

Professor Lakdas Fernando  
Head/Textile Technology

Dr. M. Jayaratne  
Materials Engineering

Mr. C.P.J. Senaratne  
Head/Mining & Minerals Engineering

sk / P.S.

JAPANESE SIDE :

1. Dr. Akira Shinohara  
Leader, Basic Design Team/Education Planner  
Dean, Faculty of Textile Science and Technology  
Shinshu University
2. Dr. Shoji Kondo  
Education Planner  
Professor, Department of Electronic Engineering  
Faculty of Engineering  
Shinshu University
3. Mr. Hiroshi Shiono  
Project Coordinator  
Second Basic Design Study Division,  
Grant Aid Planning and Survey Department,  
JICA
4. Mr. Koji Tanaka  
Senior Engineer, Equipment Planner (Chemical Fields)  
Managing Director,  
TECHNO CONSULTANTS, INC.
5. Mr. Yoshitada Kamiya  
Cost Estimator,  
TECHNO CONSULTANTS, INC.
6. Mr. Shinsuke Sato  
Equipment Layout Engineer,  
TECHNO CONSULTANTS, INC.
7. Mr. Miyoshi Nishimaru  
Equipment Planner (Electrical & Electronic Equipment)  
TECHNO CONSULTANTS, INC.

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Appendix 2 Formation of Survey Team

Dr. Akira Shinohara	Leader, Basic Design Study Team/Education Planner Dean, Faculty of Textile Science and Technology, Shinshu University
Dr. Shoji Kondo	Education Planner Professor, Department of Electronic Engineering, Faculty of Engineering, Shinshu University
Mr. Hiroshi Shiono	Project Coordinator Second Basic Design Study Division, Grant Aid Planning and Survey Department, JICA
Mr. Koji Tanaka	Senior Engineer, Equipment Planner (Chemical Fields) TECHNO CONSULTANTS, INC.
Mr. Yoshitada Kamiya	Cost Estimator, TECHNO CONSULTANTS, INC.
Mr. Shinsuke Sato	Equipment Layout Engineer, TECHNO CONSULTANTS, INC.
Mr. Miyoshi Nishimaru	Equipment Planner (Electrical & Electronic Equipment) TECHNO CONSULTANTS, INC.

Appendix 3 Survey Schedule

Date	Schedule	Visiting Site
Dec. 5 (Sat.)	LV. Narita AR. Bangkok	
Dec. 6 (Sun.)	LV. Bangkok AR. Colombo	
Dec. 7 (Mon.)	Courtesy call, explanation of field survey schedule, meeting and background survey	JICA office
		Embassy of Japan
		Dept. of External Resources (At JICA office)
		Ministry of Higher Education
Dec. 8 (Tue.)	Meeting on schedule, explanation of field survey and observation of laboratories	University of Moratuwa
Dec. 9 (Wed.)	Survey on background and related institutions	Ministry of Higher Education
		CINTEC (Computer and Information Technology Council of Sri Lanka)
	Survey on background, executing organization and maintenance organization	University of Moratuwa Dept. of Textile Tech. Dept. of Electrical/ Electronic and Telecom./Computer Science/ Mathematics/Chemical Eng./Materials Eng.
Dec. 10 (Thu.)	Survey on requested equipment, executing organization and maintenance organization	University of Moratuwa

Date	Schedule	Visiting Site
Dec. 11 (Fri.)	Survey on request and organization	
	Luncheon	Embassy of Japan
	Preparation on Minutes of Discussions	University of Moratuwa
Dec. 12 (Sat.)	Conclusion of Minutes of Discussions	Ministry of Higher Education
Dec. 13 (Sun.)	LV. Colombo AR. Bangkok	Leave for Japan (Dr. Shinohara, Prof. Kondou and Mr. Shiono)
Dec. 14 (Mon.)	LV. Bangkok AR. Narita	
Dec. 14 (Mon.)	Survey on requested equipment and specification	University of Moratuwa Department of Electrical Eng. Dept. of Materials Eng. Dept. of Electronic and Telecom. Dept. of Chemical Eng.
Dec. 15 (Tue.)	Survey on requested equipment and specification	University of Moratuwa Dept. of Chemical Eng. Dept. of Electrical Dept. of Materials Eng. Dept. of Electronic & Telecom.
	Background survey and data collection (Inland transportation, customs, port handling)	Ceylon Manufacturers & Merchants Ltd. (C.M & M) Port Authority
Dec. 16 (Wed.)	Survey on requested equipment and specification	University of Moratuwa Dept. of Chem. Eng. Dept. of Electrical Dept. of Electronic & Telecom. Dept. of Textile Tech.
	Background survey and data collection	Customs
Dec. 17 (Thu.)	Survey on requested equipment, specification, utilities, maintenance, etc.	University of Moratuwa Dept. of Textile Tech. Dept. of Computer Science Dept. of Materials Eng.

Date	Schedule	Visiting Site
Dec. 18 (Fri.)	Survey on requested equipment and specification, etc.	University of Moratuwa Dept. of Computer Science Physical Education Dept. of Chemical Eng. Language Laboratory Common Facility Library Dept. of Textile Tech.
	Background survey and data collection (Inland transportation)	Ceylon Manufactures & Merchants Ltd.
Dec. 19 (Sat.)	Survey on requested equipment and specification	University of Moratura Dept. of Computer Science
Dec. 20 (Sun.)	Internal meeting	
Dec. 21 (Mon.)	Progress reporting	JICA office
	Survey on each laboratory	University of Moratuwa Dept. of Materials Eng. Dept. of Mathematics Language Lab.
	Background survey and data collection (Warehouse)	Lanka Machine Leasers (PVT) Ltd.
	Progress meeting	
Dec. 22 (Tue.)	Background survey for graduates	Sri Lanka Electricity Board Mouldex Limited Kundanmalls Group of Companies
	Survey on each laboratory and specification	University of Moratuwa Dept. of Electrical Dept. of Electronic & Telecom. Dept. of Computer Science Eng. Library Dept. of Chemical Eng. Dept. of Materials Eng. Language Lab.
	Background survey and data collection (Labour situation, etc.)	Ceylon Manufacturers & Merchants Ltd. Coopers & Lybrand

Date	Schedule	Visiting Site
Dec. 23 (Wed.)	Schedule meeting and greeting	JICA office Embassy of Japan Ministry of Higher Education Dept. of External Resources
	Survey on each laboratory	University of Moratuwa Physical Education Eng. Library
Dec. 24 (Thu.)	LV. Colombo AR. Bangkok	
Dec. 25 (Fri.)	LV. Bangkok AR. Narita	

Appendix 4 List of Interviewed Persons

(1) Sri Lanka Side

1) Ministry of Higher Education

Dr. F.S.C.P. Kalpage	Secretary, Chairman/University Grants Commission
Mr. D.A. Samaraweera	Senior Assistant Secretary
Mr. Nimal Samarasundera	Senior Assistant Secretary
Miss D.F.C. Hanwella	Accountant/University Grants Commission

2) Department of External Resources, Ministry of Finance and Planning

Mr. Senarat Weerapana	Assistant Director
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3) The University of Moratuwa

Prof. Willie Mendis	Vice-Chancellor
Prof. G.L.K. Tennakoon	Dean/Engineering Department
Prof. Sam Karunaratne	Head/Electrical Engineering
Dr. (Mrs.) I. Dayawansa	Head/Electronic & Telecommunication Engineering
Dr. A.S. Induruwa	Head/Computer Science & Engineering
Prof. Lakdas Fernando	Head/Textile Technology



Prof. P.A. De Silva	Head/Mechanical Engineering
Dr. (Mrs.) Aruna Samaraweera	Head/Materials Engineering
Mr. C.P.J. Senaratne	Head/Mining & Minerals Engineering
Dr. M. Jayaratna	Teaching Assist./Materials Engineering
Dr. M.P. Dias	Lecturer/Electrical Engineering
Dr. B.S. Samarasiri	Assist. Lecturer/Electronic & Telecommunication
Dr. Kamal Fernando	Lecturer/Chemical Engineering
Mr. D.M. Vilathgamuwa	Assist. Lecturer/Electrical Engineering
Dr. P.D.D. Rodrigo	Lecturer/Materials Engineering
Miss S.L. Jayasuriya	Teaching Assist./Textile Technology
Mr. D.P.D. Dissanayake	Lecturer/Textile Technology
Mr. N.G.H. De Silva	Lecturer/Textile Technology
Dr. M. Jayaratna	Teaching Assist./Materials Engineering
Mr. P.N.A. Dassanayaka	Director/Physical Education
Mr. E.H.D.P. Hettiarachch	Instructor/Physical Education
Ms. N.D. Abaysakera	Head/English Language Teaching Center
Mr. Henry Jayaweera	Instructor/English Language Teaching Center

Mrs. R.C. Kabikara Junior Assist. Librarian

Mr. A.D. Leelaratna Maintenance Engineer

Mr. Yasuhiro Kawada Japan Overseas Cooperation Volunteers/  
Computer Science

4) CINTEC ( Computer and Information Technology Council of Sri Lanka )

Prof. V.K. Samarayanke Acting Chairman

5) Ceylon Manufacturers & Merchants Ltd.

Mr. Politha Ratnayake Competent Authority

Mr. T.M.H. Sampan Executive, Import

Mr. R.S.P. Pathmaperuma Executive, Marketing

6) Port Authority

Mr. K.S.C. De Fanseka Manager Director

Mr. W.G. Samaraturya Manager/Planning Research and  
Development Div.

Mr. S. Denis David Assist. Finance Manager

7) Customs

Mr. C. Rajasingham Assist. Collector

Mr. H.H.M. Suyoof E.B. Creasy & Co., Ltd.

8) Lanka Machine Leasers (PVT) Ltd.

Mr. J.K. Lankathilake                      Chief Engineer

9) Sri Lanka Electricity Board

Mr. Ranjit F. Fouseka                      Director, Training

10) Mouldex Limited

Mr. R. Rom Karunaratne                      Factory Manager

11) Kundanmala Group of Companies

Mr. Huni Kundanmal                      Managing Director

(2) Japan Side

1) Embassy of Japan

Mr. Yasunari Hamamoto                      Ambassador

Mr. Toshinao Urabe                      Counsellor

Mr. Kazuhiko Maruyama                      First Secretary

Mr. Masashi Sakuramata                      Second Secretary

2) Japan International Cooperation Agency, Colombo Office

Mr. Jirou Hashiguchi                      Director/Resident Representative

Mr. Tetsuo Amagai                         Assistant Resident Representative

3) The Institute of Computer Technology (Computer Center in the University of Colombo)

Mr. Ryo Takagi                              Team Leader

Mr. Suzuo Shibata                         Assistant Team Leader

Mr. Kazuhiko Tanaka                      Coordinator

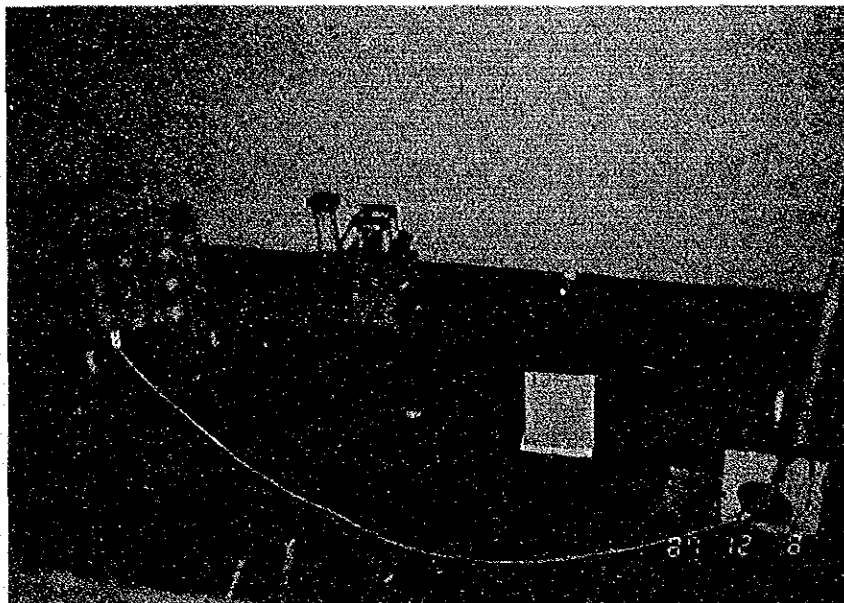
Appendix 5 List of Collecting Data

- (1) The University Grants & the Universities of Sri Lanka
- (2) Foreign Assistance for University Education
- (3) Number of Graduates Registered, Trained and Employed under the Graduate Placement Scheme
- (4) Corporate Plan for University Education 1986-1990
- (5) Universities of Sri Lanka Hand Book 1985
- (6) Link Programmes
- (7) University of Moratuwa, Sri Lanka  
Textile Technology
- (8) Clothing Technology
- (9) Curriculum and Draft Syllabuses of B.Ss Engineering
- (10) Public Investment 1986-1990
- (11) Industrial Policy Statement Government of Sri Lanka
- (12) Tax Exemption Forms
- (13) Total Output of Graduates from Universities According to Academic Stream: 1983-1985
- (14) University of Moratuwa Sri Lanka Student Handbook 1987
- (15) Textile Technology Complex
- (16) Plan of University of Moratuwa Sri Lanka
- (17) The Employers' Federation of Ceylon
- (18) The Employers' Federation of Ceylon  
Leave, Holidays and Overtime in the Private Sector
- (19) The Employers' Federation of Ceylon  
Disciplinary Action and Disciplinary Procedures in the Private Sector
- (20) The Employers' Federation Hand Book 1984
- (21) Parliament of the Democratic Socialist Republic of Sri Lanka  
Universities Act No. 16 of 1978
- (22) Parliament of the Democratic Socialist Republic of Sri Lanka  
Universities (Amendment) Act. No. 7 of 1985
- (23) Ferguson's Sri Lanka Directory 1983-85 (122nd Edition)
- (24) Map around Colombo and Moratuwa City
- (25) Manual on Establishment of Residential office in Sri Lanka (In Japanese)

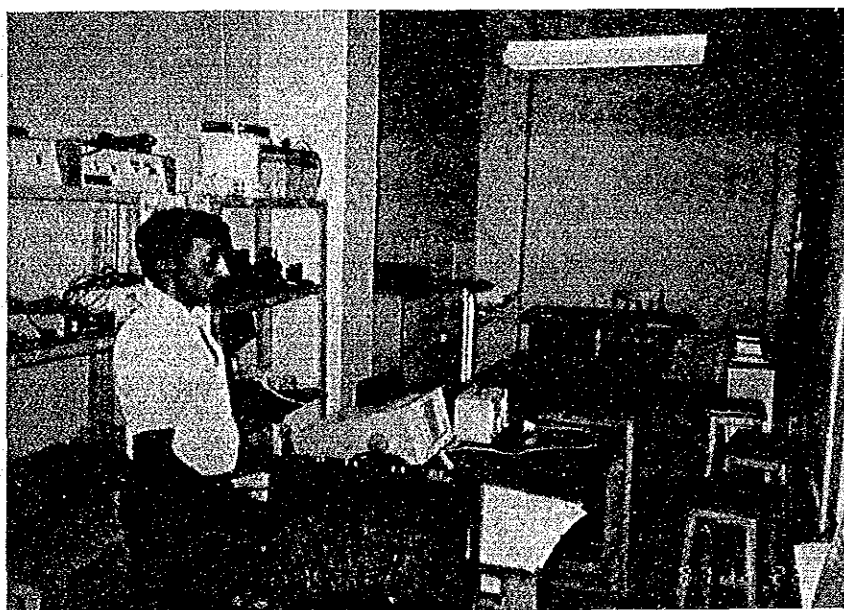
- (26) Central Bank of Sri Lanka Annual Report 1986
- (27) Central Bank of Sri Lanka Review of the Economy 1986
- (28) Tariff
- (29) The Gazette of the Democratic Socialist Republic of Sri Lanka
- (30) Public Investment 1987-1991
- (31) Central Bank of Sri Lanka Bulletin
- (32) Performance January-June, 1987
- (33) Sri Lanka Customs Import Tariff Guide, 1987
- (34) Statistical Abstract of the Democratic Socialist Republic of Sri Lanka 1985

Appendix 6 Photography

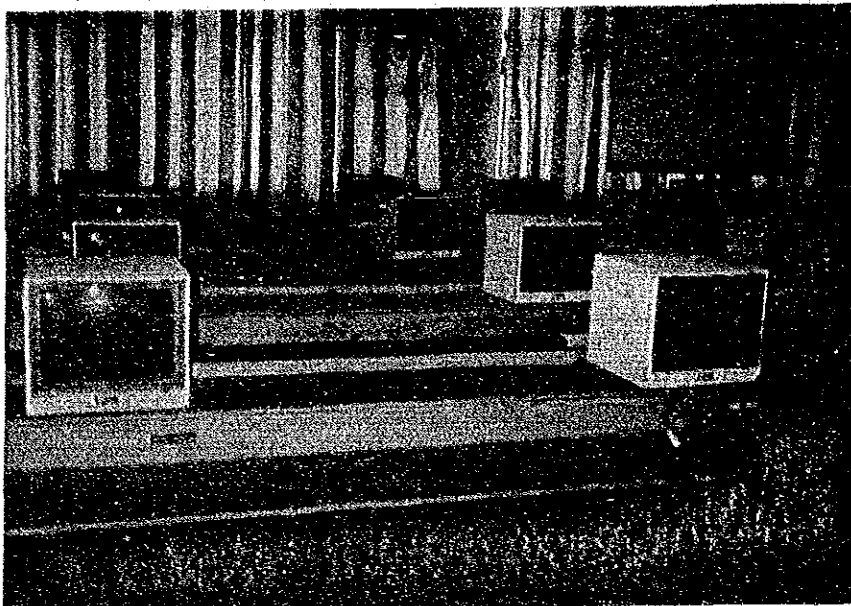
(1) Department of Electrical Engineering (High Voltage Lab.)



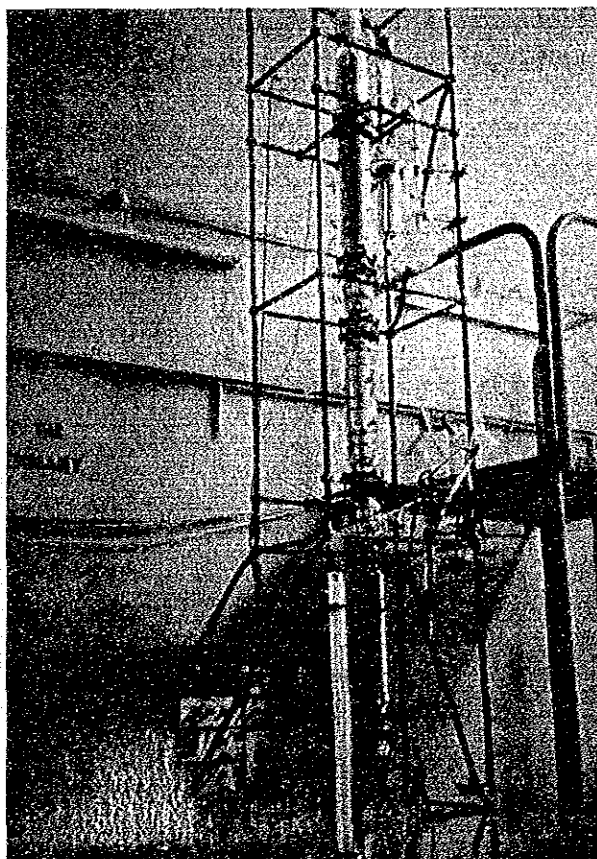
(2) Department of Electronic & Telecommunication Engineering  
(Opto Electronics Lab.)



(3) Department of Computer Science & Engineering  
(Microcomputer Lab.)

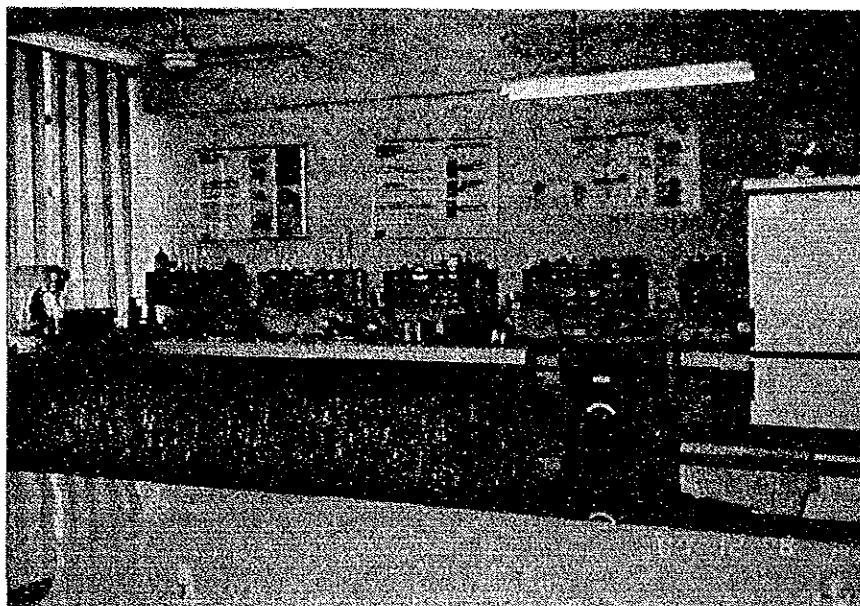


(4) Department of Chemical Engineering/Chemical Eng. Div.  
(Unit operations Lab.)

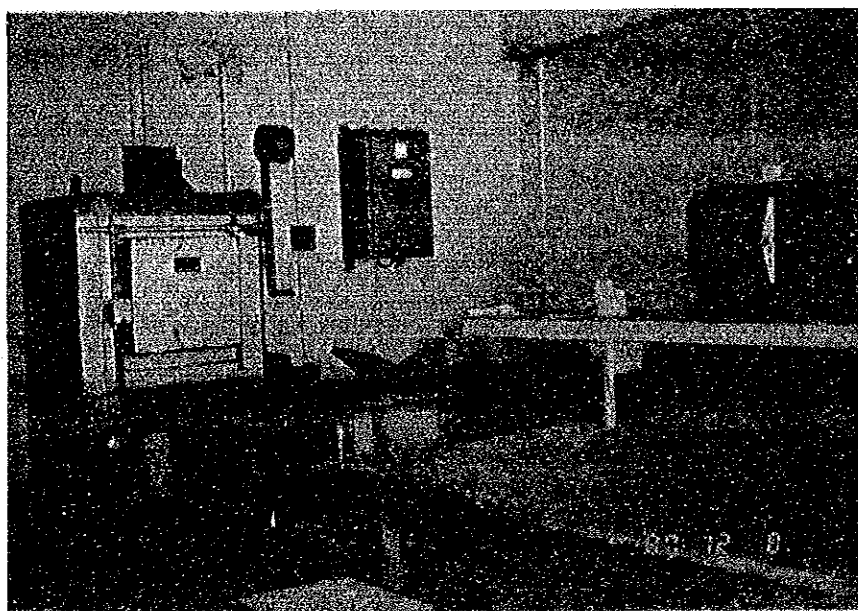




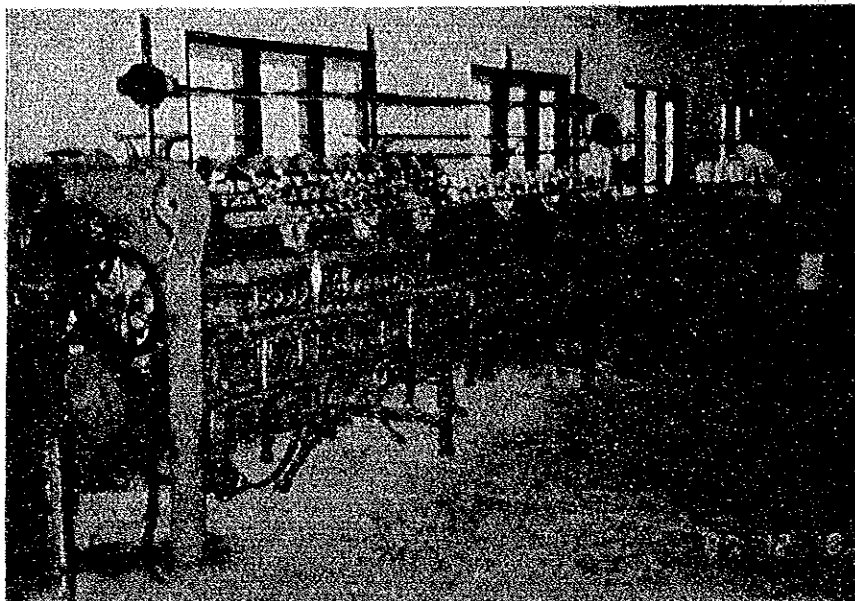
(5) Department of Chemical Engineering/Polymer Tech. Div.  
(Processability Lab.)



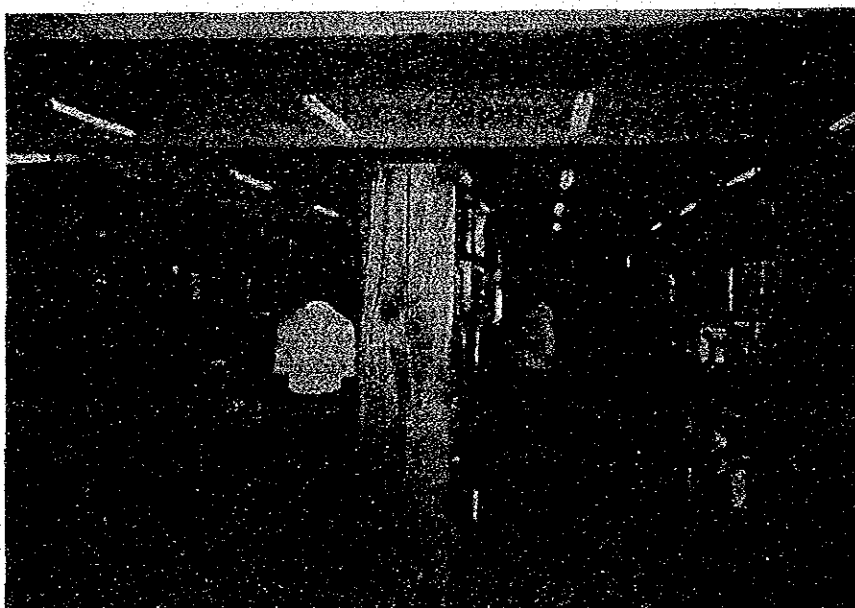
(6) Department of Materials Engineering  
(Material Testing Lab.)



(7) Department of Textile Technology  
(Spinning Lab.)



(8) Library (Lending div.)









JICA