

## **CHAPTER 3 IMPLEMENTATION PLAN**

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### **3-1 Implementation Plan**

#### **3-1-1 Implementation Concept**

The project is designed to provide educational equipment for the University of Engineering and Technology, Lahore under a grant aid project by the Japanese government. In the implementation stage, the university as the project executing agency will commission to a Japanese consultant detailed design, preparation and distribution of tender documents, tender evaluation and supervision of equipment installation. The university will also enter into contract with a contractor who will procure, transport and install equipment and instruct operation and maintenance methods and procedures to the university's staff. In the installation stage, unpacking and installation will be carried out by local workers under the supervision of Japanese engineers assigned by the contractor. Then, wiring, the fitting of accessories and parts, commissioning, and adjustment will be made by responsible engineers of the contractor. The engineers in each of the following field will be assigned; general laboratory apparatus; measuring instruments and testing equipment (electrical and electronic); laboratory training equipment (medium-size kits); analytical equipment; computers and peripherals; laboratory training equipment (floor type, assembled); measuring instruments and testing equipment (mechanical); laboratory training equipment (desktop type, assembled); and general equipment, machinery and tools. A general organization of the installation and related work is shown in Fig.3-1 on the next page.

#### **3-1-2 Implementation Conditions**

The University of Engineering and Technology, Lahore has a single term starting in every September. To minimize disturbance with its activities by installation, commissioning and adjustment, a proper schedule needs to be established in consultation with administrative staff, including work procedures and sequences being adjusted in accordance with the schedule of using laboratories and classrooms.

The university's office hours are between 8 a.m. through 2 p.m. (class hours are up to 4 p.m.) in the winter season, and between 7 a.m. through 1:30 p.m. (class hours are up to 2:30 p.m.) in the summer season. Sundays are holidays and Fridays are half-holidays due to the mass prayer. In addition, during the month of Ramadan which is scheduled between end-December 1998 and end-January 1999, workers' productivity may go down as they are prohibited from taking meals and drinks between sunrise and sunset. After Ramadan, there will be a few holidays. If equipment is to be transported or installed during Ramadan, careful consideration and planning will be required.

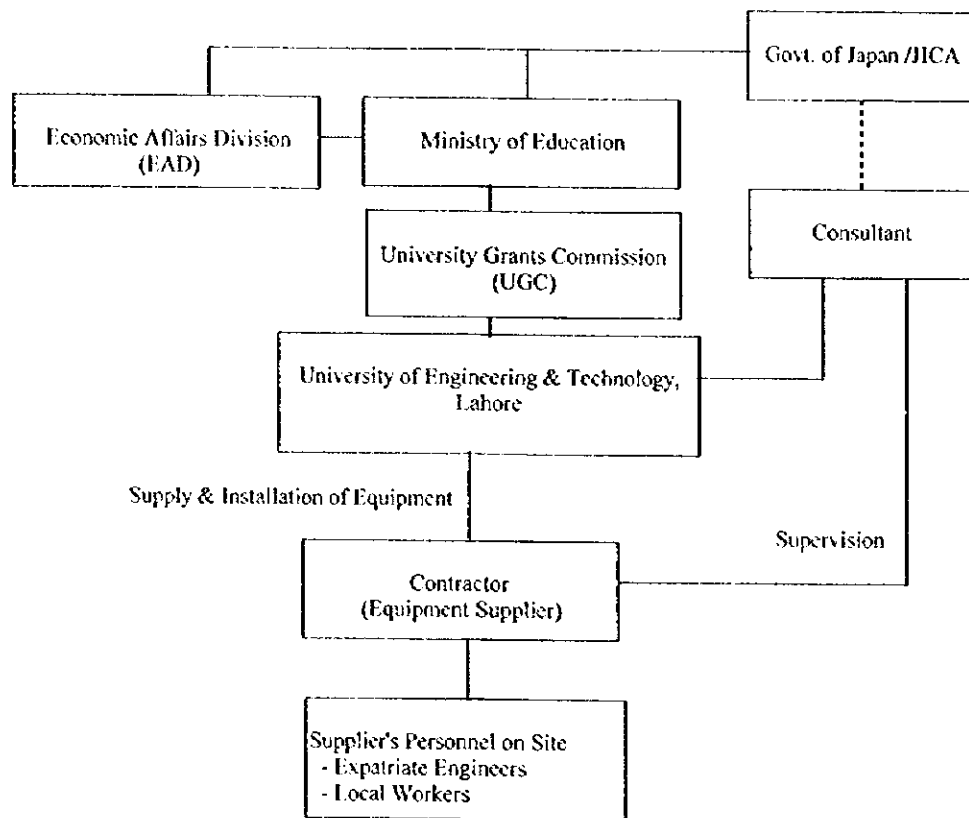


Fig. 3-1 Project Implementation System

### 3-1-3 Scope of Works

#### Pakistan side (as required)

- ① Interior work of buildings
- ② Electric work for power receiving and distribution
- ③ Water supply and drainage work
- ④ Electric lighting work
- ⑤ Ventilation work
- ⑥ Telephone and communication work
- ⑦ Procurement of furniture and fixtures
- ⑧ Procurement of chemicals and consumable
- ⑨ Payment of fees and charges for related services

#### Japanese side

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

### 3-1-4 Consultant Supervision

Based on the grant aid policy of the Japanese government and the consulting agreement, the consultant will be required to organise a project team to carry out detailed design and work supervision on the basis of principles and criteria set in the basic design process, thereby to implement the project on schedule to its completion. The project team will consist of six members, including five engineers who will be responsible for overall management, equipment planning in mechanical and metallurgical fields, equipment planning in electrical and electronic fields, equipment planning in civil engineering and mining fields, and equipment planning in the fields of physical and chemical analyses (including chemical engineering and petroleum engineering), and one specialist responsible for estimation of the project costs. The consultant will, in a neutral position, finalise in consultation with the executing agency detailed specifications for equipment to be supplied and draft tender documents,

followed by tendering and application for approvals and permits of the Japanese government. In the tender evaluation and negotiation process, the consultant will assist the representative of the executing agency to ensure a smooth progress of the project. At the supervision stage, the consultant will provide technical assistance for the executing agency in relation to the approval of drawings in Japan, followed by attendance and supervision during shop inspection, installation, and delivery. The consultant's engineer will supervise the installation, acceptance, and delivery at the project site.

### 3-1-5 Procurement Plan

#### (1) Procurement method

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

##### 1) Computer equipment

Computers made in Japan are designed to use Japanese language, such as keyboard and ROM, and are out of consideration. Selection should be made from Japanese products with export specifications or those made in other countries. In this case, in consideration to the ease of upgrading such as RAM and hard disk, procurement should be made through a sales agent in Pakistan. Note that major international computer manufacturers have local agents in the country. In addition, software programmes in Urdu are only available in country. As of December 1997, entry models available in Pakistan are equipped with Pentium 166-200MHz, 16-32Mb RAM, and 1-2Gb hard disk.

##### 2) Printers and copiers

Equipment which requires periodical maintenance, such as printers and copiers, should preferably be purchased through local agents in consideration to the need for

consumable stores as well as the availability of maintenance service. In Pakistan, manufacturers from Japan, the U.S., the U.K., and other countries have sales agents.

Equipment locally procured will be subject to import duties, provincial and federal taxes, which amounts are changed frequently. It is difficult to enjoy tax exemption privilege if a product on market is purchased. Instead, the buyer will have to obtain a certificate of tax exemption from the customs and pick up the product kept in a bonded area.

## (2) Transportation

Ocean and land transport will be done by using containers to reduce the period required for transportation and protect products. Containers will be landed at the Karachi Port, while customs clearance can be made in Lahore. To reduce time required for customs clearance, procedures should be taken in Lahore.

### 3-1-6 Implementation Schedule

The implementation schedule of the Project is shown in Fig. 3-2.

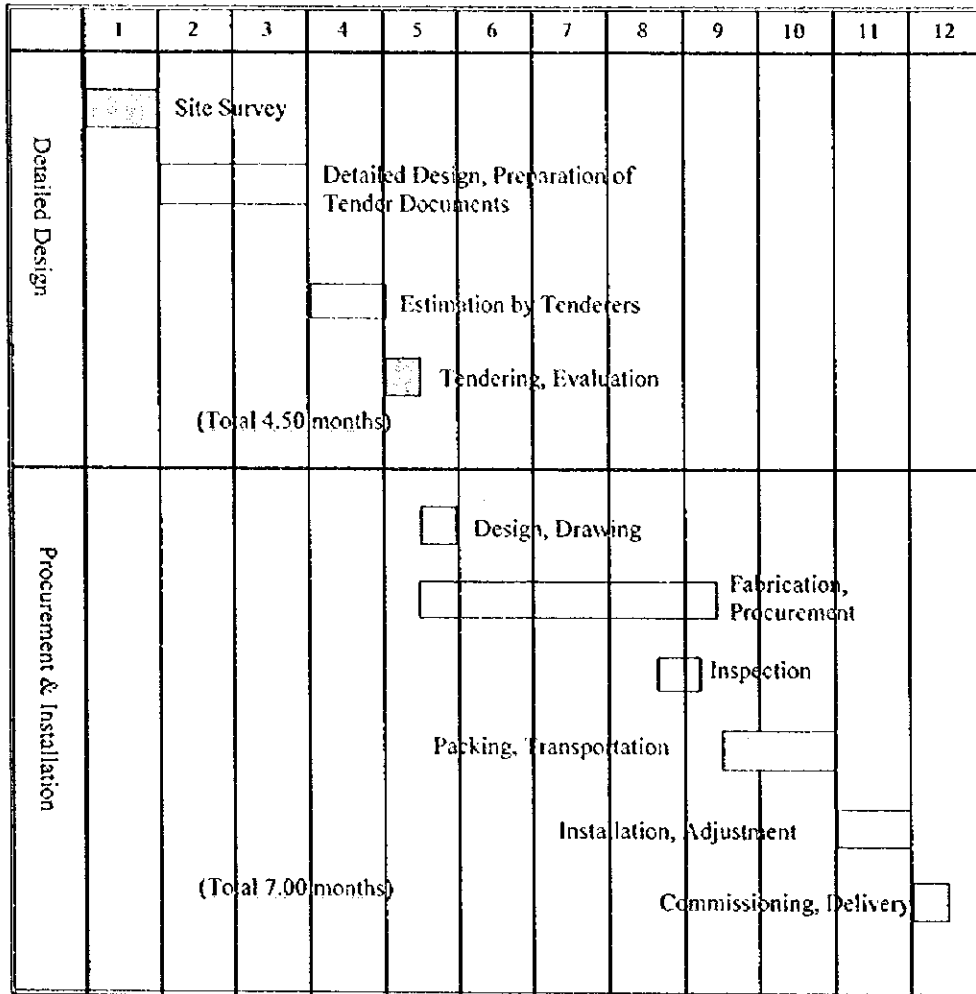


Fig. 3-2 Implementation Schedule

### 3-1-7 Obligations of Recipient Country

In the implementation of the Project, the recipient country shall attend to the following matters:

- 1) To take necessary procedures for the unloading, custom's clearance and inland transportation of equipment, and to bear all the expenses required by the procedures.
- 2) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in Pakistan with respect to the supply of the goods and services under the verified contracts.
- 3) To bear commissions to an authorized foreign exchange bank in Japan for the banking services based on the Banking Arrangement.
- 4) To accord Japanese nationals whose service may be required in connection with the project such facilities as may be necessary for their entry into Pakistan and stay therein for the performance of their work.
- 5) To operate and maintain the equipment provided by the grant aid properly and effectively.
- 6) To proceed with approvals necessary to carry on the project.
- 7) To ensure the budget and personnel required to operate and maintain the equipment provided by the project properly and efficiently.
- 8) To bear all other expenses that are not covered by the grant aid but may be necessary to carry out the project.

### 3-2 Project Cost Estimation

The costs to be born by the Pakistan side are estimated at about 24 million rupees. The breakdown is as follows:



**Table 3-1 Costs to be born by the Pakistan Side**

Works	Amount (Rs. 1,000)
Interior works, provision of facilities, etc. (Department-wise break down)	16,680.0
Civil Engineering	2,093.1
Electrical Engineering	2,189.5
Mechanical Engineering	2,066.6
Mining Engineering	1,507.5
Metallurgical Engineering	516.7
Chemical Engineering	2,312.4
Petroleum Engineering	1,660.0
Institute of Environmental Engineering & Research	542.0
Architecture	1,059.0
City & Regional Planning	175.0
Computer Science	576.0
Mathematics	135.5
Chemistry	164.0
Physics	443.5
Workshop	806.0
Library	433.3
Bank charges	7,408.0
<b>Total</b>	<b>24,088.0</b>

### 3-3 Operation and Management

Laboratory equipment will be operated by either faculty members (professors, associate professors, assistant professors, lecturers, etc.) or technical staff (laboratory managers, technical instructors, laboratory attendants, etc.). Computers, microscopes, measuring instruments, and other simple equipment generally used for laboratory work will be operated by students. Daily maintenance (primary maintenance) will be performed by a responsible faculty member or technical staff assigned to each department. On the other hand, corrective maintenance (secondary maintenance) will be taken care of by workshops in the case of a minor failure. Otherwise it will be handled by the manufacturer's agent.

The maintenance cost, although varying with equipment utilization rates, is roughly estimated at 27 million yen (approx. 8.5 million rupees) annually, as summarized in Table 3-2.

**Table 3-2 Estimated Maintenance Cost**

<b>1. Utility Costs (*)</b>			
a) Power	152,145 KWII x @	11.70 yen =	1,780,097
b) Gas	1,042 M3 x @	11.00 yen =	11,464
c) Water (**)	27,889 M3 x @	0.00 yen =	0
		Sub Total	1,791,561
<b>2. Consumable</b>			
(2% per annum of equipment which needs consumable)	185,000,000 x 2%		3,700,000
<b>3. Repair/maintenance fee (***)</b>			
(2% per annum of all equipment)	1,060,000,000 x 2%		21,200,000
		Grand Total	26,691,561

(\*) Based on operation rate of 25% of equipment simultaneously, 4 to 7 hours operation per day, 180 days use per year

(\*\*) Water is supplied by university's own deep tube well.

(\*\*\*) Represent the average cost for repair and maintenance of major equipment.

The university has requested a 10% increase in annual maintenance cost (ordinary expenditures) after FY1998-99 to the government to cover additional maintenance requirements for all the equipment to be supplied under the project. The FY1998/99 budget consisting of equipment maintenance and repair costs and equipment purchase costs is 14,050,000 Rupees. If a portion of 40% of total utilities costs allocated to educational activities (excluding those for dormitories and faculty housing which represent 60%) totaling 15,990,000 Rupees are added, the total maintenance budget is approximately 30 million rupees. Thus, the budget seems to be sufficient to cover maintenance requirements for equipment to be supplied under this project, in light of a much lower failure rate of latest educational equipment as well as the fact that the approximately 40% of the existing equipment will be removed after the project is completed.

Note that the annual operating budget of the University of Engineering and Technology, Lahore is disbursed by the Ministry of Education of the federal government via UGC. To ensure smooth maintenance of the equipment to be supplied, budget allocation to the university has been given of priority by these two supervising organizations (use of tuition and other revenues of the university).

## **CHAPTER 4 PROJECT EVALUATION AND RECOMMENDATION**

## CHAPTER 4 PROJECT EVALUATION AND RECOMMENDATION

### 4-1 Project Effect

#### (1) Enhancement of educational impact

At the University of Engineering and Technology, Lahore, course materials used for laboratory work (textbooks, reference books, etc.) are prepared by faculty members on the basis of course materials they have used during their study at foreign universities or of knowledge obtained through various journals and publications. Recently, engineering education in industrialized countries, as well as other countries, is rapidly computerized and automated. Also, as advanced technologies are quickly adopted by industry, the university must teach them in laboratory work, allowing students to keep abreast of them. In recognition of such needs, the Ministry of Education intends to develop human resources, modify the educational curriculum, and promote cooperation between industry and academia for the purpose of ensuring the development and dissemination of new technologies and fields in higher education. In reality, however, the university provides laboratory work by using obsolete equipment which is not fully functional, and the shortage of laboratory equipment prevents many students from having hands-on experiments, often resulting in conceptual understanding of important technologies. The lack of engineering education without practical training has negative impacts on the industrial development progress as students are sent to production fields without adequate problem solving capabilities, which are emphasized at a national planning level. The proposed equipment will create opportunities for students to understand practical and scientific methodology of fact finding, improve their technical skills and knowledge, and perform their work more effectively after graduation.

#### (2) Improvement of educational circumstances

More than 60% of faculty members of the university have studied at foreign universities including the U.S. and the U.K. to obtain higher degrees.

They have experience in using a variety of laboratory equipment that are widely in the countries, and have written research papers and dissertations by applying rational and scientific methodology. However, as soon as they return from overseas study, they face constraints on educational activities due to the shortage of adequate equipment. To develop the learning environment where students are effectively stimulated, it is desirable that instructors can prepare course materials according to the level of understanding and use equipment suitable for understanding scientific principles that are intended to be taught. Clearly, the current situation makes it difficult for both instructors and students to achieve their goals. The proposed equipment helps faculty members overcome the difficulty, and at the same time, they will effectively be motivated to participate in the exchange of knowledge and experience with industry people by improving technical skills and learning new technologies. The increased interaction will allow the refinement of course materials to meet changing industrial needs, which will in turn increase the educational effect.

### (3) Contribution to industry

The project covers a variety of departments and will help students learn, among other things, a wide range of technologies related to exploration, recovery, processing, reproduction, and preservation of natural resources which are abundant in the country, as well as the planning and maintenance of infrastructure, business administration and corporate management. In terms of economic activity, the university's education is virtually related to most of sectors, including mining, construction, transportation and communication, and power and gas, in addition to manufacturing. Each year, around 900 students graduate from the university and most of them work with public organizations (government, research institutes, educational institutions) and private companies. In particular, they are expected to make the following contributions:

- Development of industries to use locally available resources for manufacture and processing
- Development of agro-based products, and quality control and improvement

- Development of production technologies and quality improvement
- Quality control and improvement of mining products
- Exploration and development of new mining resources
- Exploration and development of energy resources
- Construction and upgrading of infrastructure
- Construction and upgrading of public health facilities
- Construction and upgrading of pollution control facilities
- Development and management of on-line systems
- Market development, marketing and sales management of local products
- Corporate management

Through the activities of the graduates in public organizations and private companies, the effect of the university's education is expected to disseminate throughout the Punjab province which accounts for 56% of total population, and then to the rest of the country.

Although the project is not profitable in nature, it is expected to produce long-standing benefits, both direct and indirect. In addition, it will not have significant environmental impacts. For these reasons, it is considered to be appropriate for the project to implement this project under a grant aid of the Japanese government.

#### **4-2 Recommendation**

As the project will produce diverse and considerable benefits and can contribute to the improvement of basic human needs (BHN), it is justifiable to implement the project under the Japanese government's grant aid cooperation. Also, Pakistan has sufficient resources and funds to maintain the proposed equipment properly. To maximize the effect of the project, the following recommendations are made.

## 1) Training for equipment operation and maintenance technology

The University of Engineering and Technology, Lahore has a sufficient stock of persons capable of doing daily operation and maintenance of equipment, i.e., faculty members and technical staff. Also, most of instructors have obtained master's or doctoral degree from universities in industrialized countries and have sufficient knowledge and skills to operate the proposed equipment. Nevertheless, as some equipment incorporates new technologies, it is important for the caretakers to learn their operation as soon as possible and use them effectively in the long run. In particular, for equipment which operation and maintenance is considered to be relatively difficult, it is desirable to provide sufficient training at the site after installation, followed by special training sessions for operation and maintenance personnel to be provided by the university.

## 2) Monitoring of budget allocation

The university earmarks equipment repair and maintenance costs (not including utilities charges) equivalent to 3% of its overall budget. In the FY1997-98 budget, approximately 5.8 million rupees are being applied. In addition, the university estimated local costs to implement the project (electrical installation, lighting, air-conditioning and ventilation, office furniture and fixtures, and banking charges) at 24 million rupees, which were included in the request proposal (PC-1) and submitted to the government. The request proposal was approved in November 1997 by CDWP under the Ministry of Planning, and by ECNEC in January 1998. Furthermore, the university plans to secure 7,650,000 rupees for repair and maintenance costs under the FY1998-99 budget when the proposed equipment will be installed, and an additional budget at an incremental rate of 10% annually in the following years. This budget allocation seems to be sufficient in light of the fact that the repair cost will not incur in the first year because of the manufacturer's warranty period, and that most equipment will require a relatively small amount of maintenance cost. Nevertheless, as the budget holds the key to the effective use of equipment as planned, it is recommended to monitor actual disbursement of the budget from

time to time.

**3) Strengthening of cooperation and exchange between the university and the industry as well as other education and research institutes**

The University of Engineering and Technology, Lahore offers educational opportunity for students to work and study at companies, called the familiarisation programme. On the other hand, many students in the master's courses (part-time) are in-service engineers working with private companies and absorb technical know-how of the university through lectures and refresher courses. It is important to maintain such cooperation between the university and industry by exchanging knowledge on latest production technology and machinery, thereby to improve technical skills on the both sides. Also, the university promotes interaction with foreign universities and research organizations in the fields of education and research. It is desirable to further encourage such activities and proceed with international research initiatives on common themes, which would help improve technology levels of the university, while contributing to the long-term and efficient use of the proposed equipment.



## APPENDICES

## APPENDIX-1 MEMBER LIST OF THE STUDY TEAM

Yoshiaki SAKAMAKI	Team Leader	Managing Director, Kanto Branch, JICA
Tetsunori HIRAHARA	Project Coordinator	Coordination and Appraisal Division, Grant Aid Project Study Department, JICA
Wataru SHIGA	Chief Consultant (Equipment Planner)	UNICO International Corporation
Dr. Yasuo SHIBATA	Engineering Education Specialist	UNICO International Corporation
Shuhei KUBOTA	Equipment Planner/Cost Estimator	UNICO International Corporation

**APPENDIX-2 SURVEY SCHEDULE**

No.	Date	Day	Itinerary	City
1	97/10/20	Mon	L.v. Tokyo - Ar. Islamabad (12:55-20:15 by PK853)	Islamabad
2	97/10/21	Tue	Courtesy calls to Embassy of Japan (EOJ), JICA Pakistan Office, Ministry of Education (MOE), Economic Affairs Division (EAD) L.v. Islamabad - Ar. Lahore (20:30-21:20 by PK389)	Lahore
3	97/10/22	Wed	Courtesy call to the University of Engineering & Technology Lahore (UETL) and site survey	Lahore
4	97/10/23	Thu	Site survey and meeting at UETL	Lahore
5	97/10/24	Fri	Discussion with UETL	Lahore
6	97/10/25	Sat	Discussion with UETL, Signing the Minutes of Discussions with Vice-Chancellor	Lahore
7	97/10/26	Sun	(Messrs. Sakamaki, Hirahara, Shiga) L.v. Lahore - Ar. Islamabad (22:01-22:50 by PK384) (Messrs. Shibata, Kubota) Market survey in Lahore	Islamabad Lahore
8	97/10/27	Mon	(Messrs. Sakamaki, Hirahara, Shiga) Report to EOJ, JICA, MOE (Messrs. Shibata, Kubota) Discussion with UETL (Mr. Sakamaki) L.v. Islamabad - Ar. Karachi (19:05-21:00 by PK309)	Islamabad Lahore
9	97/10/28	Tue	(Mr. Sakamaki) L.v. Karachi for Singapore (08:15 by PK870) (Messrs. Hirahara, Shiga) L.v. Islamabad - Ar. Faisalabad (19:00-20:10 by PK657) (Messrs. Shibata, Kubota) Discussion with UETL	Faisalabad Lahore
10	97/10/29	Wed	(Messrs. Hirahara, Shiga) Visit to National College of Textile Engineering and the University of Agriculture, Faisalabad L.v. Faisalabad for Lahore by car (Messrs. Shibata, Kubota) Discussion with UETL	Lahore
11	97/10/30	Thu	Discussion with UETL (Mr. Hirahara) L.v. Lahore for Bangkok (23:50 by TG506)	Lahore
12	97/10/31	Fri	Discussion with UETL	Lahore
13	97/11/01	Sat	Discussion with UETL	Lahore
14	97/11/02	Sun	Market survey in Lahore	Lahore
15	97/11/03	Mon	Discussion with UETL	Lahore
16	97/11/04	Tue	Discussion with UETL	Lahore
17	97/11/05	Wed	Discussion with UETL	Lahore
18	97/11/06	Thu	Discussion with UETL	Lahore
19	97/11/07	Fri	Discussion with UETL	Lahore
20	97/11/08	Sat	Discussion with UETL	Lahore
21	97/11/09	Sun	L.v. Lahore - Ar. Islamabad (12:25-13:15 by PK386)	Islamabad
22	97/11/10	Mon	Report to EOJ, JICA, MOE (Mr. Shiga) L.v. Islamabad - Ar. Karachi (19:05-21:00 by PK309)	Karachi Islamabad
23	97/11/11	Tue	(Mr. Shiga) Market survey in Karachi (Messrs. Shibata, Kubota) L.v. Islamabad - Ar. Lahore (20:30-21:20 by PK389) L.v. Lahore for Bangkok (23:50 by TG506)	Karachi Inflight
24	97/11/12	Wed	(Mr. Shiga) L.v. Karachi - Ar. Bangkok (02:55-09:45 by TG508) (Messrs. Shibata, Kubota) Ar. Bangkok (06:15 by TG506)	Home-bound

### APPENDIX-3 LIST OF PARTY CONCERNED IN THE RECIPIENT COUNTRY

#### Ministry of Education

Dr. Abdul Aziz Khan	Joint Educational Adviser (Planning)
Mr. Bashir Ahmad Chaudhry	Assistant Educational Adviser

#### University Grants Commission

Dr. S. M. Hassan	Director General
------------------	------------------

#### Economic Affairs Division

Mr. Rashid Mahmood Ansari	Joint Secretary
Mr. S. M. Hasan Zaidi	Deputy Secretary

#### University of Engineering and Technology, Lahore

Dr. Shaheen Akhtar	Vice-chancellor, Prof., Civil Engineering Dept.
Dr. K. E. Durrani	Prof., Electrical Engineering Dept.
Dr. Tabrez A. Shami	Project Coordinator, Prof., Electrical Engineering Dept.
Mr. Zulfiqar Ali Shah	Registrar
Mr. Mohammad Aslam	Treasurer
Mr. Ahmad Saeed Shaikh	Prof., Chairman, Civil Engineering Dept.
Dr. A. K. Salariya	Prof., Chairman, Chemical Engineering Dept.
Dr. Qamar Iqbal	Prof., Chairman, Chemistry Dept.
Dr. M. Mahmood Ahmad	Prof., Chemical Engineering Dept.
Dr. Ahmad Khan Raja	Prof., Chairman, Computer Science Dept.
Dr. M. Iqbal Hussain	Prof., Chairman, Mechanical Engineering Dept.
Dr. M. Saleem Shuja	Prof., Chairman, Metallurgical Eng'g & Materials Science Dept.
Dr. Mahmood Hussain	Prof., Dean, Faculty of Architecture & Planning
Mr. Arif Ali	Prof., Chairman, Petroleum Engineering Dept.
Dr. Muhammad Bashir Sadiq	Prof., Chairman, Mathematics Dept.
Dr. Noor Muhammed Shaikh	Prof., Chairman, Electrical Engineering
Dr. Nazir A. Butt	Prof., Chairman, Mining Engineering Dept.
Dr. Saleem Ahmad Kayani	Prof., Chairman, Physics Dept.

Dr. Abdul Gaffar Khan	Prof., Dean, Faculty of Chemical, Mineral and Metallurgical Eng'g
Dr. Javed Anwar Aziz	Prof., Director, Institute of Environmental Eng'g & Research
Dr. Mahmood Ahmad	Assoc. Prof., Chemistry Dept.
Mr. A. Sattar Sikandar	Prof., Chairman, City & Regional Planning Dept.
Dr. Shaukat Mahmood	Prof., Chairman, Architecture Dept.
Dr. Muhammad Amjad	Prof., Dean, Faculty of Basic Sciences
Dr. Yousaf Ali Akhtar	Prof., Computer Science Dept.
Mr. Amir Abdullah Malik	Sr. Instructor, University Workshop

Many other professors, associate professors, assistant professors, lecturers, instructors, etc., with whom Study Team met and held discussions, are not listed hereupon only due to limitation of space.

#### **JICA Pakistan Office**

Mr. Kazuo Nakagawa	Resident Representative
Mr. Noriaki Nagatomo	Deputy Resident Representative
Mr. Mahmood A. Jilani	Deputy Resident Representative

#### **Embassy of Japan**

Mr. Minoru Kubota	Ambassador
Mr. Fukuichiro Tanaka	Chief of Economic Section
Mr. Makoto Nojiri	First Secretary

(The name list is not in order.)

APPENDIX-4 MINUTES OF DISCUSSIONS

Minutes of Discussions  
on  
the Basic Design Study  
on  
the Project for Improvement of Educational Equipment  
for the University of Engineering and Technology, Lahore  
in  
The Islamic Republic of Pakistan

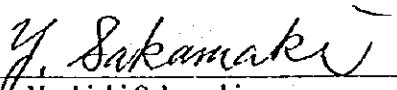
In response to the request made by the Government of the Islamic Republic of Pakistan, the Government of Japan has decided to conduct a Basic Design Study on the Project for Improvement of Educational Equipment for the University of Engineering and Technology, Lahore (hereinafter referred to as "the Project"), and entrusted the study to the Japan International Cooperation Agency (JICA).


JICA sent to the Islamic Republic of Pakistan a study team (hereinafter referred to as "the Team"), headed by Mr. Yoshiaki Sakamaki, Managing Director of Kanto Branch, JICA, and is scheduled to stay in the country from 20th October to 12th November, 1997.

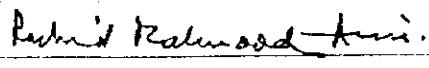
The Team held discussions with the officials concerned of the Government of the Islamic Republic of Pakistan and conducted a field survey at the study area.

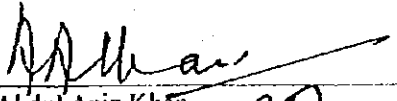
As a result of the discussions and a field survey, both parties have confirmed the main items described on the attached sheets. The Team will proceed to further work and prepare the Basic Design Study Report.

Lahore, 25th October, 1997

  
Mr. Yoshiaki Sakamaki  
Leader,  
Basic Design Study Team,  
Japan International Cooperation Agency

  
Prof. Dr. Shaheen Akhtar  
Vice-chancellor,  
University of Engineering and  
Technology, Lahore

  
(RASHID MAHMOOD ANSARI)  
JOINT SECRETARY  
ECONOMIC AFFAIRS DIVISION  
GOVERNMENT OF PAKISTAN  
ISLAMABAD

  
Dr. Abdul Aziz Khan  
Joint Educational Adviser,  
Ministry of Education,  
Government of Pakistan

## ATTACHMENT

### 1. OBJECTIVE OF THE PROJECT

The objective of the Project is to strengthen and upgrade the educational activities of the University of Engineering and Technology, Lahore through provision of essential educational equipment.

### 2. PROJECT SITE

The University of Engineering and Technology, Lahore

### 3. PROJECT IMPLEMENTING AGENCY

- (1) Responsible Agency      Ministry of Education, Government of Pakistan
- (2) Executing Agency      University of Engineering and Technology, Lahore

### 4. ITEMS REQUESTED BY THE GOVERNMENT OF THE ISLAMIC REPUBLIC OF PAKISTAN

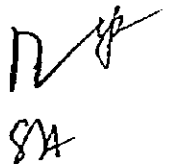
After discussions with the Team, equipment for the teaching departments and relevant sections described in Annex-I, which would be necessary for education in the University of Engineering and Technology, Lahore was finally requested by the Pakistan side.

Both sides have agreed, however, that the final components of the Project will be decided by the Basic Design Study Team after further studies in Japan on the basis of the scheme of Japan's Grant Aid Programme.

### 5. JAPAN'S GRANT AID PROGRAMME

(1) The Government of the Islamic Republic of Pakistan has understood the system of Japan's Grant Aid Programme as described in Annex-II.

(2) The Government of the Islamic Republic of Pakistan will take necessary measures, as

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described in Annex-III for the smooth implementation of the Project, on condition that the Grant Aid by the Government of Japan is extended to the Project.

## 6. SCHEDULE OF THE STUDY

- (1) The consultants will proceed to further studies in the Islamic Republic of Pakistan until 11th of November, 1997.
- (2) The list of items decided by the Basic Design Study Team after further studies in Japan will be sent to the Islamic Republic of Pakistan by 31st of December, 1997.
- (3) In case that the contents of the Project are accepted in principle by the Government of the Islamic Republic of Pakistan, JICA will complete the final report and send it to the Government of the Islamic Republic of Pakistan by March, 1998.

## 7. OTHER RELEVANT ISSUES

- (1) The Pakistan side indicated to the Team that it had the plan for the requested educational equipment and the concept of the Project was reviewed and confirmed in the discussions.
- (2) Both sides confirmed as follows.

The equipment to be given higher priority in the Project are:

- a) the equipment to be replaced with the existing equipment which is already deteriorated, outdated or obsolete.
- b) the equipment to be added to the existing ones that are in short of quantity in consideration of the size and frequency of laboratory experiments or classes.
- c) the essential equipment for indispensable curricula of education.

While, the equipment to be given lower priority in the Project are:

- d) the equipment with major difficulties on installation / infrastructure condition.
- e) the expensive equipment for infrequent use.
- f) the equipment with financial / marketing difficulties on the procurement of consumable and spare parts etc.

- (3) Pakistan side confirmed that the Ministry of Education of the Islamic Republic of Pakistan and the University of Engineering and Technology, Lahore have the responsibility of monitoring progress of each phase of the Project and reporting it to






the Embassy of Japan and JICA Pakistan Office annually through Economic Affairs Division, provided that the Japan's Grant Aid is extended to the Project.

- (4) The Pakistan side confirmed that the necessary recurring cost and personnel for the educational equipment newly provided shall be secured by the Ministry of Education of the Islamic Republic of Pakistan/University of Engineering and Technology, Lahore.
- (5) Existing equipment which is not necessary after the procurement of new equipment shall be removed by the Pakistan side through the proper procedure.
- (6) Pakistan side will submit the answers to the questionnaire to the Team one by one as soon as possible but not later than 8th November, 1997.
- (7) Pakistan side requested short-term training of the personnel for the operation and maintenance of the equipment provided either during installation at the site or in Japan.

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## List of Departments and Laboratories requesting Equipment

Sr. No.	Department/Laboratory	Sr. No.	Department/Laboratory
1	Civil Engineering	5	Metallurgical Engineering
	1 Concrete		1 Cast Metals Research
	2 Earthquake Engineering		2 Heat Treatment
	3 Soil Mechanics & Foundation Engineering		3 Corrosion Engineering
	4 Highway & Transportation		4 Analysis
	5 Hydraulics & Irrigation		5 Inspection & Testing
	6 Surveying		6 Computer
	7 Computer	6	Chemical Engineering
2	Electrical Engineering		1 Fluid Flow & Particle Technology
	1 Replacement of Old Equipment		2 Instrumentation & Control
	2 Trainers Required for the Departments		3 Reaction Engineering & Thermodynamics
	3 Measurement		4 Heat & Mass Transfer
	4 Electronics Engineering		5 Analytical
	5 Control System		6 Computer
	6 Communications Engineering	7	Petroleum Engineering
	7 Microwave	8	Institute of Environmental Engineering & Research
	8 Electrical Machine	9	Architecture
	9 Power System		1 Graphics & Presentation
	10 High Voltage		2 Physical Environmental Studies
	11 Computer		3 Photographic Developing & Printing
3	Mechanical Engineering		4 Surveying & Levelling
	1 Heat Transfer Thermodynamics		5 Computer
	2 Fluid Mechanics	10	City & Regional Planning
	3 Refrigeration & Air Conditioning	11	Computer Science
	4 Mechanics of Machines	12	Mathematics
	5 Material Testing	13	Chemistry
	6 CNC/CAD/CAM	14	Physics
	7 Computer	15	Workshop
4	Mining Engineering	16	Library
	1 Mine Ventilation		
	2 Mine Safety & Rescue		
	3 Mine Survey		
	4 Mineralogy & Petrology		
	5 Mineral Processing		
	6 Rock Mechanics		
	7 Computer		

  
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## Japan's Grant Aid Programme

### I. Japan's Grant Aid Procedures

1) The Japan's Grant Aid Programme is executed by the following procedures.

Application	:(Request made by a Recipient Country)
Study	:(Preliminary Study / Basic Design Study Conducted by JICA)
Appraisal & Approval	:(Appraisal by the Government of Japan and Approval by Cabinet of Japan)
Determination of Implementation	:(Exchange of Notes Between both Governments)

2) Firstly, an application or a request for a project made by the recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to see whether or not it is suitable for Japan's Grant Aid. If the request is deemed suitable, the Government of Japan entrusts a study on the request to JICA.

Secondly, JICA conducts a Basic Design Study, using a Japanese consulting firm. If the background and objectives of the requested project are not clear, a Preliminary Study is conducted prior to the Basic Design Study.

Thirdly, the Government of Japan appraises the Project to see whether or not it is suitable for Japan's Grant Aid Programme, based on the Basic Design Study Report prepared by JICA, and the results are then submitted to the Cabinet for approval.

Fourth, the Project approved by the Cabinet becomes official after the Exchange of Notes signed by both Governments.

Finally, for the implementation of the Project, JICA assists the recipient country in preparing contracts and monitoring progress.

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## 2. Contents of the Study

### (1) Contents of the Study

The purpose of the Study (Preliminary Study/Basic Design Study) conducted on a project requested by JICA is to provide a basic document necessary for appraisal of the project by the Japanese Government.

The contents of the Study are as follows:

- a) to confirm background, objectives, benefits of the project and also institutional capacity of agencies concerned of the recipient country necessary for the project implementation,
- b) to evaluate appropriateness of the Project for the Grant Aid Scheme from a technical, social and economic point of view,
- c) to confirm items agreed to by both parties concerning a basic concept of the Project,
- d) to prepare a basic design of the Project, and
- e) to estimate cost involved in the Project.

Final project components are subject to approval by the Government of Japan and therefore may differ from an original request.

In implementing the project, the Government of Japan requests the recipient country to take necessary measures involved which are itemised on Exchange of Notes.

### (2) Selecting (a) Consulting Firm(s)

For smooth implementation of the Study, JICA uses (a) consulting firm(s) registered. JICA selects (a) firm(s) through proposals submitted by firms which are interested. The firm(s) selected carry(ies) out a Basic Design Study and write(s) a report, based upon terms of reference made by JICA.

The consulting firm(s) used for the Study is(are) recommended by JICA to a recipient country after Exchange of Notes, in order to maintain technical consistency and also to avoid any undue delay in implementation caused if a new selection process be repeated.

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(1) Status of a Preliminary Study in the Grant Aid Programme

A Preliminary Study is conducted during the second step of a project formulation and preparation as mentioned above.

The result of the study will be utilised in Japan to decide if the Project is to be suitable for a Basic Design Study.

Based on the result of the Basic Design Study, the Government would proceed to the stage of decision making process (appraisal and approval).

It is important to notice that at the stage of Preliminary Study, no commitment is made by the Japanese side concerning the realisation of the Project in the scheme of Grant Aid Programme.

3. Japan's Grant Aid Scheme

(1) What is Grant Aid?

The Grant Aid Programme provides a recipient country with non-reimbursable funds needed to procure facilities, equipment and services for economic and social development of the country under the following principles in accordance with relevant laws and regulations of Japan. The Grant Aid is not in a form of donation or such.

(2) Exchange of Notes (E/N)

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

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

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- (4) Under the Grant, in principle, products and services of origins of Japan or the recipient country are to be purchased.

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

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

- (5) Necessity of the "Verification"

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

- (6) Undertakings required to the Government of the recipient country

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

- a) to secure land necessary for the sites of the project and to clear and level the land prior to commencement of the construction work,
- b) to provide facilities for distribution of electricity, water supply and drainage and other incidental facilities in and around the sites,
- c) to secure buildings prior to the installation work in case the Project provides equipment,
- d) to meet all expenses and undertake promote execution for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid,
- e) to exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified Contracts,

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

(7) Proper Use

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

(8) Re-export

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

(9) Banking Arrangement (B/A)

- a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in an authorised foreign exchange bank in Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the contracts verified.
- b) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an Authorization to Pay issued by the Government of the recipient country or its designated authority.

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**Necessary Measures to be taken  
by the Government of the Islamic Republic of Pakistan**

The Government of the Islamic Republic of Pakistan shall re-approve PC-1 and notify the Embassy of Japan in Pakistan and JICA Pakistan Office by 31st of January, 1998, if necessary.

Following necessary measures should be taken by the Government of the Islamic Republic of Pakistan on condition that the Grant Aid by the Government of Japan is extended to the Project.

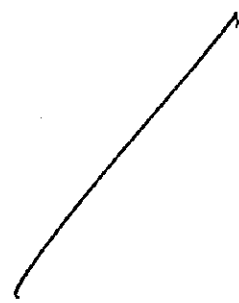
1. To provide data and information necessary for the Project,
2. to complete the relocation of the existing equipment, facilities and civil works required prior to the installation of the equipment and setting,
3. to provide facilities for distribution of electricity, water supply, telephone, drainage, sewerage and other incidental items required for the Project,
4. to allocate appropriate budget and staff members for the proper and effective operation and maintenance of equipment and setting provided under the Grant Aid,
5. to make a banking arrangement with an authorised foreign exchange bank of Japan to authorise the bank to pay and issue the Authorization to Pay (A/P) as soon as possible,
6. to bear commissions to the Japanese foreign exchange bank for its banking service based upon the Banking Arrangement (B/A), namely the advertising commission of the Authorization to Pay (A/P) and payment commission,
7. to ensure prompt unloading, tax exemption and customs clearance at the port of disembarkation in the Islamic Republic of Pakistan and prompt internal transportation therein of the materials and equipment for the Project purchased under the Grant Aid,
8. to exempt Japanese judicial and physical nationals engaged in the Project from customs duties, internal taxes and other fiscal levies which may be imposed in the Islamic Republic of Pakistan with respect to the supply of the products and services under the verified contracts,

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9. to accord Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contract such facilities as may be necessary for their entry into the Islamic Republic of Pakistan and stay therein for the performance of their work,
10. to provide necessary permissions, licenses and other authorisations for implementing the Project, if necessary,
11. to assign appropriate budget and teaching and administrative staff members for proper and effective operation and maintenance of equipment procured under the Grant Aid,
12. to maintain and use properly and effectively the equipment procured under the Project, and
13. to bear all the expenses, other than those to be borne by the Japan's Grant Aid within the scope of the Project.

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### List of Participants

#### Ministry of Education

Dr. Abdul Aziz Khan	Joint Educational Adviser (Planning)
Mr. Bashir Ahmad Chaudhry	Assistant Educational Adviser

#### University Grants Commission

Dr. S. M. Hassan	Director General
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#### Economic Affairs Division

Mr. Rashid Mahmood Ansari	Joint Secretary
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#### University of Engineering and Technology, Lahore

Dr. Shaheen Akhtar	Vice-chancellor, Prof., Civil Engineering Dept.
Dr. K. E. Durrani	Prof., Electrical Engineering Dept.
Dr. Tabrez A. Shami	Project Coordinator, Prof., Electrical Engineering Dept.
Mr. Zulfiqar Ali Shah	Registrar
Mr. Mohammad Aslam	Treasurer
Mr. Ahmad Saeed Sheikh	Chairman, Civil Engineering Dept.
Dr. A. K. Salarya	Chairman, Chemical Engineering Dept.
Dr. M. Mahmood Ahmad	Prof., Chemical Engineering Dept.
Dr. M. Saleem Shuja	Prof., Chairman, Metallurgical Eng'g & Materials Science Dept.
Dr. Mahmood Hussain	Prof., Dean, Faculty of Architecture & Planning
Mr. Arif Ali	Prof., Chairman, Petroleum Engineering Dept.
Dr. Muhammad Bashir Sadiq	Prof., Chairman, Mathematics Dept.
Dr. Noor Muhammed Shaikh	Prof., Chairman, Electrical Engineering
Dr. Nazir A. Butt	Prof., Chairman, Mining Engineering Dept.
Dr. Abdul Gaffar Khan	Prof., Dean, Faculty of Chemical, Mineral and Metallurgical Eng'g
Dr. Javed Anwar Aziz	Prof., Director, Institute of Environmental Eng'g & Research
Dr. Mahmood Ahmad	Assoc. Prof., Chemistry Dept.
Mr. A. Sattar Sikandar	Prof., Chairman, City & Regional Planning Dept.
Dr. Shaukat Mahmood	Prof., Chairman, Architecture Dept.
Dr. Muhammad Amjad	Prof., Dean, Faculty of Basic Sciences
Dr. Yousaf Ali Akhtar	Prof., Computer Science Dept.



## APPENDIX-5 REFERENCES

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2. Eighth Five Year Plan (1993-98, Extracted), (c)
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9. Academic Branch (Regulations Section), Punjab Act V of 1974 with Amendments upto 7-12-1992, University of Engineering and Technology Lahore (o)
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12. Department of Civil Engineering, Prospectus, M.Sc. Admission, University of Engineering and Technology Lahore (o)
13. Department of Computer Science, Prospectus, M.Sc. Admission, University of Engineering and Technology Lahore (o)
14. Department of Metallurgical Engineering and Material Science, Prospectus, M.Sc. Admission, University of Engineering and Technology Lahore (o)
15. Department of Chemistry, Prospectus, M.Sc. Admission, University of Engineering and Technology Lahore (o)
16. Department of City and Regional Planning, Prospectus, M.Sc. Admission, University of Engineering and Technology Lahore (o)
17. Department of Architecture, Prospectus, M.Sc. Admission, University of Engineering and Technology Lahore (o)
18. Department of Electrical Engineering, Prospectus, M.Sc. Admission, University of Engineering and Technology Lahore (o)

19. Various Answers to the Questionnaire, University of Engineering and Technology  
Lahore (c)

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## APPENDIX 6 LIST OF PLANNED EQUIPMENT

Item No.	Name of Equipment	Q'ty
<b>CIVIL ENGINEERING DEPARTMENT</b>		
<b>CONCRETE LABORATORY</b>		
CCT- 1	Compression Testing Machine	1
CCT- 2	Portable Core Drill Machine	1
CCT- 3	Heavy Duty Masonry Saw	1
CCT- 4	Resonant Frequency Tester	1
CCT- 5	Pundit Ultrasound Tester	1
CCT- 6	Micro Cover Meter	1
CCT- 7	Concrete Corrosion Mapping System	1
CCT- 8	Windsor Probe System	1
CCT- 10	Multiposition Strain Gauge	1
CCT- 12	Automatic Cement Test System	1
CCT- 13	8" Demec Gauge with Studs	4
CCT- 14	2" Demec Gauge with Studs	6
CCT- 15	Crack Detection Microscope	2
CCT- 17	Poisson's Ratio Measuring Apparatus	1
CCT- 18	Creep Test Apparatus	1
CCT- 19	Concrete Permeability Apparatus	1
CCT- 21	Thermostatic Curing Tank	1
CCT- 22	Flexure Deflection Measuring Apparatus	1
<b>EARTHQUAKE ENGINEERING LABORATORY</b>		
CEE- 1	Signal Enhancement Seismograph	1
CEE- 2	Seismic Digital Timer	1
CEE- 4	Servo Accelerometer	1
CEE- 7	Universal Testing Machine	1
CEE- 10	Electrical Balance	2
CEE- 11	Strain Gauges Measuring Apparatus	1
CEE- 12	Rockwell Hardness Machine	1
CEE- 13	Brinell Hardness Machine	1
CEE- 14	Fatigue Testing Machine	1
CEE- 16	Universal Structural Testing Frame and Experimental Kit	1
<b>SOIL MECHANICS &amp; FOUNDATION ENGINEERING LABORATORY</b>		
CSF- 2	Hydraulic Jack (100t)	1
CSF- 3	Hydraulic Jack (50t)	1
CSF- 4	Portable Cone Penetrometer	1
CSF- 6	Speedy Moisture Tester of Different Capacity	1

Item No.	Name of Equipment	Q'ty
CSF- 8	Digital Balance (Approx. 3000g/0.01g)	2
CSF- 9	Digital Balance (Approx. 6000g/0.1g)	2
CSF- 10	Digital Balance (Approx. 4000g/0.1g)	2
CSF- 11	RO-TAP Sieve Shaker	1
CSF- 13	Modified Mechanical Compactor	1
CSF- 14	Load Cells	1
CSF- 15	Transducers	1
CSF- 16	Proving Rings	1
CSF- 17	Specimen Cutting Machine	1
CSF- 19	Dial Gauges Range	1
CSF- 21	Tube Sampler Set	1
CSF- 22	Field CBR Set	1
CSF- 24	Triaxial Test System	1
CSF- 26	Digital Direct Shear Apparatus	1
CSF- 28	Expansion Index Test Apparatus	1
CSF- 29	Soil Volume Change Meter	1
CSF- 31	Power Auger	1
CSF- 32	Falling Head Permeameter	1
CSF- 33	Constant Head Permeameter	1
CSF- 34	CBR Test Set	1
CSF- 35	Particle Size Analysis Set (sieves)	1
CSF- 36	Shrinkage Limit Set	1
CSF- 37	Field Density Set	1
CSF- 39	Plate Bearing Test Set	1
CSF- 41	Water Distillation Apparatus	1
CSF- 42	Oven, Constant Temperature	1
CSF- 43	Hand Operated Liquid Limit Set	6
CSF- 44	Motorised Liquid Limit Set	1
CSF- 47	Radial Flow Permeability Apparatus	1
CSF- 48	Hydrostatic Settlement Measuring Apparatus	1
CSF- 49	De-Aired Water Apparatus	1
CSF- 50	Relative Density Set	1
CSF- 51	Balloon Density Apparatus	1
CSF- 52	Data Acquisition System for CBR, Triaxial & Shear Test	1
<b>HIGHWAYS AND TRANSPORTATION LABORATORY</b>		
CHT- 2	Marshall Test Apparatus	1

Item No.	Name of Equipment	Q'ty
CHT- 3	Asphalt Mixer	1
CHT- 4	Universal Asphalt Penetration Tester	1
CHT- 5	Saybolt Viscometer	1
CHT- 6	Benkelman Beam Test Apparatus	1
CHT- 8	Travelling Beam Device	1
CHT- 9	Ring & Ball Type Softening Point Apparatus	1
CHT- 10	Ductility Testing Machine	1
CHT- 11	Cleveland Flash Point Tester	1
CHT- 12	Oven	1
CHT- 17	Sample Extractor	1
CHT- 19	Aggregate Impact Value Apparatus	1
CHT- 20	Aggregate Crushing Value Apparatus	1
CHT- 21	Specific Gravity and Water Absorption of Aggregate	1
CHT- 22	Hot Plate	1
CHT- 23	Fan Circulated Oven	1
CHT- 24	Semi Automatic Balance	1
CHT- 25	Toploading Platform Balance (Approx. 15kg/0.1g)	1
CHT- 27	Toploading Balance (Approx. 300g/0.001g)	1
CHT- 28	Soundness Test Apparatus	1
CHT- 30	Friction Tester	1
<b>HYDRAULICS AND IRRIGATION LABORATORY</b>		
CHI- 2	Francis Turbine	1
CHI- 3	Hydraulic Bench	1
CHI- 4	Accessories for Hydraulic Bench	1
	a) Dead weight calibrator	1
	b) Hydrostatic Pressure	1
	c) Flow Over Weirs	1
	d) Metacentric Height	1
	e) Bernoulli's Theorem	1
	f) Impact of Jet	1
	g) Orifice and Free Jet Flow	1
	i) Osborne Reynolds Demonstration	1
	j) Flow Meter Demonstration	1
	l) Free and Forced Vortices	1
	n) Demonstration Pelton Turbine	1
	q) Computer Aided Learning Software for Fluid Mechanics	1
CHI- 6	Fluid Friction Apparatus	1
CHI- 7	Pipe Surge & Water Hammer Apparatus	1

Item No.	Name of Equipment	Q'ty
CHI- 8	Pitot Static Tube	3
CHI- 10	Multipump Test Rig	1
CHI- 14	Electronic Balance	2
CHI- 15	Suspended Spring Balance	4
CHI- 16	Drying Oven	1
CHI- 17	Glass Sides Tilting Flume 10m Length	1
CHI- 18	Adjustable Bed Flow Channel	1
CHI- 19	Laminar Flow Analysis Table	1
<b>SURVEYING LABORATORY</b>		
CSV- 1	Electronic Total Station	1
CSV- 3	Electronic Distance Meter (Range:Approx. 900m)	1
CSV- 4	Electronic Distance Meter (Range:Approx. 5000m)	1
CSV- 6	Six Second Digital Theodolite	3
CSV- 7	Twenty Second Digital Theodolite	3
CSV- 8	Electronic Level	1
CSV- 9	Builders Auto Level	3
CSV- 10	Digital Planimeters	3
CSV- 11	Gyroscopic Theodolite	1
CSV- 12	Vertical Sensor	1
CSV- 14	Stereoscopes	3
CSV- 15	Telescopic Alidades	3
CSV- 16	Range Finders	3
CSV- 18	Levelling Staffs	6
CSV- 19	Highway Design Software	1
CSV- 20	GPS Differential Receiver	1
<b>COMPUTERS AND PERIPHERALS</b>		
CCP- 1	Personal Computer	10
CCP- 2	Dot Matrix Printer	2
CCP- 3	Plotter	1
CCP- 4	Laser Printer	1
<b>ELECTRICAL ENGINEERING DEPARTMENT</b>		
<b>REPLACEMENT OF OLD EQUIPMENT</b>		
EER- 3	Function Generator	10
EER- 4	Power Supply	10
EER- 5	General Purpose Oscilloscope	10
EER- 6	Logic Analyzer	1
EER- 7	Digital Oscilloscope	2
EER- 11	Mega-Ohm Meter	1

Item No.	Name of Equipment	Q'ty
EER- 15	Four dial Decade Capacitor	2
EER- 16	Variable self Inductors	2
EER- 17	Precision Wheat-stone Bridge (Null Method type)	1
EER- 23	Digital Manometer	1
EER- 24	Leakage Current Tester	1
EER- 25	Sound Level Meter	1
EER- 26	Portable Frequency Meter	1
EER- 29	Electro Static Voltmeter	2
EER- 33	Withstand Voltage Tester	1
EER- 34	Portable X-Y Recorder	1
<b>TRAINERS REQUIRED FOR THE DEPARTMENT</b>		
ETN- 1	Sequence Control Trainer	1
ETN- 2	Thirister Inverted System Trainer	1
ETN- 6	Colour Television Trainer	1
ETN- 7	A/D & D/A Converter Trainer	1
ETN- 12	F.M.Modulation and Demodulation Experimental Apparatus	2
<b>MEASUREMENT LABORATORY</b>		
EME- 1	Oscilloscope	10
EME- 2	DC Regulated Power Supply	10
EME- 3	Function Generator	10
EME- 5	Auto Transformer	3
EME- 6	Earth Tester	1
EME- 7	LCR Bridge	2
EME- 8	Kelvin Bridge	2
EME- 9	Slide Register	7
EME- 10	Portable AC Voltmeter	
b)	0-150 Volts	3
c)	0-300 Volts	3
EME- 11	Portable Single Phase Watt Meter	2
EME- 12	Digital AC Power Meter	
a)	1-Phase	2
b)	3-Phase	2
EME- 13	Clip on AC Power Meter	2
EME- 14	Power Meter	6
EME- 18	Decade Inductor	3
EME- 19	Portable Current Transformer	1
EME- 20	Digital Multimeter	4
EME- 23	Digital Power Factor Meter	2

Item No.	Name of Equipment	Q'ty
EME- 26	Selector Switch	5
EME- 28	Portable Standard AC Ammeter & Voltmeter	2
EME- 30	DC Voltmeter/Ammeter	2
EME- 35	LCR Digital Meter	1
EME- 36	LCR Load Bank	1
EME- 37	Electronic Voltmeter	1
EME- 38	Digital Luxmeter	1
EME- 39	Digital Sound Level Meter	1
EME- 40	Variable Capacitor	2
EME- 41	Standard Resistors	2
EME- 42	Digital Clamp-on AC/DC Ammeter	2
EME- 43	Digital Oscilloscope	2
EME- 44	Digital Thermometer	2
EME- 45	Digital Hygrometer	1
EME- 47	Gauss Meter	1
EME- 48	Precision Digital Multimeter	1
EME- 49	Automatic Tuning Distortion Meter	1
EME- 50	Un-interruptible Power supply	1
EME- 52	Vector Multimeter	1
<b>ELECTRONICS ENGINEERING LABORATORY</b>		
EEN- 1	General Purpose Oscilloscope	10
EEN- 7	Digital Trainer	10
EEN- 8	Analogue Trainer	10
EEN- 9	Power Supplies	10
EEN- 10	Electronics Circuit Trainer	2
EEN- 11	Operational Amplifier Trainer	2
EEN- 12	Pulse Circuit Experimental Equipment	2
EEN- 13	A-D/D-A Converter Trainer	2
EEN- 15	Logic Circuit Equipment	
a)	Type A	2
b)	Type B	2
c)	Type C	2
EEN- 16	SCR Circuit Trainer	2
EEN- 18	Semi Conductor Experimental Equipment	1
EEN- 19	Power Supply Circuit Equipment	
a)	Type A	1
b)	Type B	1
EEN- 20	Logic Analyzer	1



Item No.	Name of Equipment	Qty
FEN- 21	Function Generator	
a)	Type A (0.02Hz - 2GHz)	5
b)	Type B (0.1Hz - 10MHz)	5
EEN- 22	Sweep Generator	1
FEN- 23	Frequency Response Tester	1
FEN- 24	Digital Frequency Counter	
a)	Type A (10Hz - 80MHz)	1
b)	Type B (Direct:10Hz - 80MHz, Pre-scale: 50MHz - 500MHz)	1
EEN- 27	Digital Oscilloscope	2
FEN- 28	Transistor Tester	2
EEN- 29	Automatic Distortion Meter	2
EEN- 30	Noise Meter	2
EEN- 32	Linear IC Tester	1
FEN- 33	Logic Tester	2
<b>CONTROL SYSTEM LABORATORY</b>		
ECS- 1	DC Speed Control Training System	2
ECS- 2	AC Servo and Synchro System	2
ECS- 3	Air Flow, Temperature Control Training System	2
ECS- 5	Linear Variable Differential Transformer Training System	2
ECS- 6	Linear Variable Differential Capacitor Training System	2
ECS- 7	Strain Gauge Training System	2
ECS- 8	Digital Servo Workshop	1
ECS- 9	Magnetic Levitation System	1
ECS- 10	Digital Pendulum Control System	1
ECS- 11	Twin Rotor Mimo System	1
ECS- 12	Software for ECS-8 to ECS-11	1
ECS- 13	Pneumatic control Teaching Mechanism	1
ECS- 14	Hydraulic Servo System	1
ECS- 15	Transducers Training kit	1
<b>COMMUNICATION ENGINEERING LABORATORY</b>		
ECN- 1	Spectra Analyzer	
a)	Type A (10kHz - 2GHz)	1
b)	Type B (2GHz/Coupled Input Type)	1
c)	Type C (SHF Range 30GHz)	1
ECN- 2	Sampling Oscilloscope	
ECN- 3	LCR Meter	1
ECN- 9	Universal Counter	2
ECN- 16	Pulse Circuit Experimental Equipment	1

Item No.	Name of Equipment	Qty
ECN- 17	Digital RF Termination Power Meter	2
ECN- 19	VHF Signal Generator	2
ECN- 20	Pulse Generator	2
ECN- 21	Automatic Audio Test Set	2
ECN- 25	Frequency Synthesizer	1
ECN- 28	Oscilloscope	5
ECN- 29	Regulated Power supply	
a)	Type A (18V/5A)	2
b)	Type B (36V/10A)	2
c)	Type C (70V/1A)	2
ECN- 35	Computer Aided Analogue and Digital Communication Trainer	2
ECN- 36	Transmission Line Demonstrator	2
ECN- 37	Antenna System Demonstrator	2
ECN- 38	Antenna Modeling System	1
ECN- 39	Digital Telephony Training System	1
ECN- 40	Digital Switching System	1
ECN- 43	Fibre-optics Training System with Power Meter and Monitor	2
<b>MICROWAVE LABORATORY</b>		
EMR- 1	Microwave education test bench	2
EMR- 40	Wide Micro-strip Training System with Software	1
<b>ELECTRICAL MACHINE LABORATORY</b>		
EML- 1	Power Supply Unit	1
EML- 2	Measurement Module	1
EML- 3	Load Benches (Eddy Current Brake and Transducer Assembly)	10
EML- 4	Test Machines	
a)	Three phase induction squirrel cage motor	1
b)	Single phase induction motor	1
c)	Three phase induction motor	1
d)	D.C. motor with shunt Excitation	1
e)	D.C. motor with series Excitation	1
f)	D.C. motor with compound Excitation	1
g)	D.C. Generator with shunt and compound Excitation	1
h)	Universal Motor	1
i)	Split Phase Motor	1
j)	Two Speed Induction Motor (Squirrel Cage)	1
EML- 6	Starter for A-C/D-C Machines	1
EML- 7	Rheostats for D-C Machines	1
EML- 8	Excitation Rheostats for A-C/D-C Machine	1

Item No.	Name of Equipment	Qty
EML- 10	Base for connection together as assembly	10
EML- 14	Advance Electrical Machine 4Q Drive System, Microprocessor Based Measuring System	1
EML- 15	AC Motor Drive with Built-in Vector Visualizer Frequency Converter	1
EML- 16	4Q DC Motor Drive Module	1
EML- 17	DC Link Filter	1
EML- 18	Basic Power Electronics Unit with Accessories	1
EML- 19	DC Tachometer Generator (for EML 16)	1
EML- 20	Inverter Bridge	1
<b>POWER SYSTEM LABORATORY</b>		
EPS- 1	Power System Simulation Software, network planning and network optimization, alongwith accessories	1
EPS- 2	Complete laboratory control and monitoring equipment and software package for the power station simulation	1
EPS- 3	Power System laboratory or equivalent with following modules	1
(1)	Power Plant Module with High Voltage Busbars and Outgoing Lines	1
(2)	Transmission Lines Module	1
(3)	Receiving Substation Module with High Voltage Side and Medium Voltage Feeders	1
(4)	Load Module	1
<b>HIGH VOLTAGE LABORATORY</b>		
HV- 1	Iron Loss Tester	1
HV- 3	Digital Micro Ohm meter	2
HV- 4	Automatic Schering Bridge	1
HV- 5	Tan Delta Calibration Set	1
HV- 6	Instrument Transformer Test Set	1
HV- 9	Earth Resistance Tester	1
HV- 12	Impulse Voltage Generating Equipment	1
HV- 15	Surge Scope	1
HV- 18	Tensile Tester	1
HV- 19	Digital Micrometer	2
HV- 20	Digital Caliper	2
HV- 21	Profile Projector	1
HV- 22	Precision Balance	1
HV- 23	Precision Sample Cutter	1
HV- 24	Digital Hygrometer	1
HV- 26	Null Detector for EHV Schering Bridge	1
HV- 27	Voltage Regulator	1
HV- 30	Multi Function Calibrator	1
HV- 31	Multi Voltage Insulation Tester	1
HV- 33	Digital Oscilloscope with Printer	1
HV- 34	A.C. Voltmeter	1

Item No.	Name of Equipment	Qty
<b>COMPUTER &amp; PERIPHERALS</b>		
ECP- 1	Personal Computer	10
ECP- 5	Overhead Projector with screen	1
<b>MECHANICAL ENGINEERING DEPARTMENT</b>		
<b>HEAT TRANSFER AND THERMODYNAMICS LABORATORY</b>		
MHT- 1	Steam Power Plant	1
MHT- 2	Engine Test Bed	1
MHT- 5	Emission Analyzer	1
MHT- 6	Photovoltaic Trainer	1
MHT- 8	Temperature Measurement Unit	1
MHT- 9	Concentric Tube Heat Exchanger	1
MHT- 10	Bench Top Demo Cooling Tower with Columns	1
MHT- 11	Thermal Conductivity of Liquid & Gases Apparatus	1
MHT- 12	Boiling Heat Transfer Unit	1
MHT- 13	Turbulent Flow Heat Exchange, Water to Water	1
MHT- 18	Cross Flow Heat Exchanger	1
<b>FLUID MECHANICS LABORATORY</b>		
MFM- 1	Basic Hydraulic Bench with Attachments	1
MFM- 2	Practical Training Package for Compressors, Pumps and Turbines	1
MFM- 6	Compressible Flow Bench	1
MFM- 7	Educational Wind Tunnel	1
MFM- 11	Nozzle Performance Study System	1
<b>REFRIGERATION AND AIR CONDITIONING LAB</b>		
MRA- 1	Mechanical Heat Pump	1
MRA- 2	Recirculating Air Conditioning Unit	1
MRA- 3	Humidity Measuring Bench	1
<b>MECHANICS OF MACHINES LAB</b>		
MML- 1	Static and Dynamic Balancing Apparatus	1
MML- 2	Whirling Shaft Apparatus	1
MML- 3	Angular Acceleration Apparatus	1
MML- 5	Torsional Vibration Apparatus	1
MML- 6	Vibration Apparatus	1
<b>MATERIAL TESTING LABORATORY</b>		
MMT- 1	Universal Testing Machine	1
MMT- 2	Metallurgical/Industrial Microscope	1
MMT- 3	Charpy Impact Testing Machine	1
<b>CNC/CAD/CAM TRAINING LABORATORY</b>		
MCD- 1	Instructors Workstation	1

Item No.	Name of Equipment	Qty
MCD- 2	Student Workstation	10
MCD- 3	CNC Milling Machine	1
MCD- 4	CNC Lathe	1
MCD- 5	Software	1
MCD- 7	6 Pen Plotter	1
<b>COMPUTER &amp; PERIPHERALS</b>		
MCP- 1	Personal Computer	10
MCP- 2	Dot Matrix Printer	2
MCP- 3	Color Plotter	1
MCP- 4	Laser Printer	1
<b>MINING ENGINEERING DEPARTMENT</b>		
<b>MINE VENTILATION LABORATORY</b>		
MMV 2	Geiger Counter	1
MMV 4	Radon Detector	1
MMV 5	Total Sulphur Estimation Apparatus for Coal	1
MMV 6	Diesel Smoke Tester	1
MMV 7	Psychrometer	1
MMV 9	Hot Wire Anemometer	1
MMV 10	Constant Temp. Hot Wire Anemometer	1
MMV 13	Digital Hygrometer	1
MMV 14	Digital Manometer	1
MMV 15	Aneroid Barometer	1
MMV 16	Altimeter	1
MMV 17	Mine Ventilation Educator	1
MMV 18	Layering of Roof Gases Apparatus	1
MMV 19	Air Velocity Monitor	1
MMV 20	Smoke Indicator	1
MMV 22	Oxygen Meter	1
MMV 23	Sound Level Meter	1
MMV 24	Digital Dust Indicator	1
MMV 25	Electronic Dust Sampler	1
MMV 26	Total & Respirable Dust Sampler	1
MMV 27	Carbon Dioxide Meter	1
MMV 28	Portable Carbon Monoxide Detector	1
<b>MINE SAFETY AND RESCUE LABORATORY</b>		
MSR- 2	Portable Gas Detector	1
MSR- 3	Multi Toxic Gas Monitor	1
MSR- 4	Escape Apparatus	1

Item No.	Name of Equipment	Qty
MSR- 5	Self Rescuer Respirator	1
MSR- 6	Self Rescuer Training Model	1
MSR- 7	Drager Explosimeter Warnex	1
MSR- 8	Oxygen Breathing Apparatus	1
MSR- 9	Single Gas H2S Personal Monitor	1
MSR- 13	Lightning Detector	1
MSR- 14	Electric Blasting Machine	1
MSR- 15	Shock Tube Initiator Set (2 types)	2
MSR- 16	Blasting Digital Multimeter	1
<b>MINE SURVEY LABORATORY</b>		
MMS- 2	Planimeter, Electronic	1
MMS- 4	Total Station with Traverse Target System	1
MMS- 5	Digital Theodolite with Tripod	1
MMS- 6	Optical Theodolite with Tripod	2
MMS- 7	Traverse Target Set	2
MMS- 8	Tilting Level with Tripod	2
MMS- 9	Range Finder	2
MMS- 10	Range Height Finder	2
MMS- 11	Auto Reduction EDM Alidade with Plane Table	1
MMS- 13	Digital Level with Fiberglass Level Rod	1
<b>MINERALOGY AND PETROLOGY LABORATORY</b>		
MPM- 1	Collection of Rocks	2
MPM- 2	Rock and Mineral Collections	2
MPM- 3	Collection of less common Rock and Minerals	1
MPM- 4	Moh's Hardness Test Set	10
MPM- 5	Rock Cutting and Trimming Machine	1
MPM- 6	Resistivity Meter	1
MPM- 7	Permeameter	1
<b>MINERAL PROCESSING LABORATORY</b>		
MMP- 1	Vibratory Mill, Lab. Type	1
MMP- 2	Digital Gauges Meter	1
MMP- 3	Laboratory Electronic Jig	1
MMP- 5	Lab. Model Plate Electrostatic Separator	1
MMP- 6	Lab. Model Screen Plate Electrostatics Separator	1
MMP- 7	Jumbo Sieves Set	1
MMP- 8	Hardgrove Grindability Testing Machine	1
MMP- 9	Lab. Flotation Machine	1
MMP- 13	High Intensity Wet Magnetic Separator	1

Item No.	Name of Equipment	Qty
MMP-14	Vibro Sieve Shaker	1
MMP-15	Zirconium Crucibles	20
MMP-16	Air Classifier	1
MMP-17	Ultrasonic Sieve Cleaner	1
MMP-22	Gyratory Screen Shaker	1
MMP-23	Desister Packaged Unit Gravity Table	1
MMP-24	Multigravity Separator Lab. Unit	1
MMP-26	XRF Chemical Analysis Equipment for Minerals and Rocks	1

#### ROCK MECHANICS LABORATORY

MRM-1	Portable Shear Box Assembly	1
MRM-2	Rock Specimen Preparation Machine	1
MRM-3	Data Logger	2
MRM-4	Triaxial Compression Machine	1

#### COMPUTER & PERIPHERALS

MNC-1	Personal Computer	5
MNC-2	Dot Matrix Printer	1
MNC-3	Plotter	1
MNC-4	Laser Printer	1
MNC-5	Digitizer	1
MNC-6	Computer Data Projector	1
MNC-7	Overhead Projector	1

#### METALLURGICAL ENGINEERING & MATERIAL SCIENCE DEPARTMENT

##### CAST METALS RESEARCH LABORATORY

LCR-1	Furnace	1
LCR-4	Temperature Chart Recorder	2
LCR-8	Permeability Tester	2
LCR-9	Sand Testing Washer	2
LCR-10	Sand Mill	2
LCR-11	Universal Sand Strength Machine	2

##### CORROSION ENGINEERING LABORATORY

LCE-2	Coating Thickness Measurement Device	4
LCE-3	Corrosion Studies Kit	1

##### ANALYSIS LABORATORY

LAL-1	Digital Electronic Balance	3
LAL-4	Optical Emission Spectrometer	1
LAL-5	Carbon-Sulphur Apparatus	1

##### INSPECTION & TESTING LABORATORY

LIT-3	Digital Micro Hardness Tester	1
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Item No.	Name of Equipment	Qty
LIT-5	Digital Rockwell Hardness Tester	1
LIT-6	Digital Brinell Hardness Tester	1
LIT-7	Charpy Impact Tester	1
LIT-11	Transmitted Light Microscope	1

#### HEAT TREATMENT LABORATORY

LHT-1	Furnace	1
LHT-2	Muffle Furnace	1
LHT-5	Pyrometer	2

#### CHEMICAL ENGINEERING DEPARTMENT

##### FLUID FLOW & PARTICLE TECHNOLOGY LABORATORY

CFP-1	Hydraulic Bench	1
CFP-2	Compressible Flow Bench	1
CFP-4	Fixed and Fluidized Bed Apparatus	1
CFP-9	Sedimentation Study Apparatus	1
CFP-11	Osborne Reynolds Apparatus	1
CFP-12	Multi Pump Test Rig	1
CFP-13	Centrifugal Compressor Demo Unit	1
CFP-14	Drag Coefficients of Particle Apparatus	1
CFP-23	Jaw Crusher	1
CFP-24	Ball Mill	1
CFP-26	Roll Crusher	1
CFP-27	Standard Sieve Set with Shaker	2
CFP-29	Microscope	1
CFP-33	Centrifugal Fan Demo Unit	1

##### INSTRUMENTATION & CONTROL LABORATORY

CIC-1	Process Module	1
CIC-2	Electrical Console	1
CIC-3	Laboratory Recorder	1
CIC-4	Data Logger	1
CIC-5	Level Control Accessory	1
CIC-6	Temperature Control Accessory	1
CIC-7	Pressure Control Accessory	1
CIC-8	Programmable Control Accessory	1
CIC-9	pH Control Accessory	1
CIC-10	Remote Set Point Control Accessory	1
CIC-11	Flow Control Accessory	1
CIC-12	Computer Control Accessory	1
CIC-13	Process Control Trainer	1

Item No.	Name of Equipment	Qty
<b>REACTION ENGINEERING &amp; THERMODYNAMICS LABORATORY</b>		
CRT- 1	Continuous Stirred Tank Reactor	1
CRT- 2	Tubular Flow Reactor	1
CRT- 3	Stirred Tank in Series	1
CRT- 4	Batch Reactor	1
CRT- 8	Joule-Thomson Effect Apparatus	3
CRT- 9	Sectioned Diaphragm Pump	1
CRT- 12	Boyle-Charles Law Apparatus	1
<b>HEAT &amp; MASS TRANSFER LABORATORY</b>		
CHT- 1	Thermal Radiation Apparatus	1
CHT- 2	Free & Forced Convection Heat Transfer Apparatus	1
CHT- 5	Cross Flow Heat Exchanger	1
CHT- 6	Cooling Tower	1
CHT- 7	Mass Transfer and Diffusion Coefficient Apparatus (Liquid & Gases)	1
CHT- 8	Liquid Extraction Unit	1
CHT- 10	Fluidized Bed Drier	1
CHT- 12	Distillation Apparatus Packed Column, Computer Interfaced	1
CHT- 14	Batch Fractionation Pilot Plant	1
CHT- 15	Boiling Heat Transfer Unit	1
CHT- 18	Ion Exchange Unit	1
CHT- 19	Concentric Tube Heat Exchanger	1
CHT- 23	Gas Absorption Column	1
CHT- 24	Tray Drier	1
CHT- 25	Drum Drier	1
<b>ANALYTICAL LABORATORY</b>		
CAL- 1	Photometer Analyzer for Kinetic Enzyme	1
CAL- 2	Inverted Biological Microscope	1
CAL- 9	Digital Refractometer	1
CAL- 18	Fluorescence Spectrometer	1
CAL- 24	Differential Thermal Analyzer	1
CAL- 27	Gas Calorimeter	1
CAL- 43	Tube furnace (Complete)	1
CAL- 47	Atomic Absorption Spectrometer	1
CAL- 54	Furnace	1
CAL- 55	General Purpose Oven	2
CAL- 60	Carl Fisher Titrator	6
CAL- 63	Water Still	1
CAL- 65	pH Meter	1

Item No.	Name of Equipment	Qty
<b>COMPUTER &amp; PERIPHERALS</b>		
CCP- 1	Personal Computer	5
CCP- 4	Laser Printer	1
<b>PETROLEUM ENGINEERING DEPARTMENT</b>		
PED- 2	Core Slabbing Saw	1
PED- 3	Soxhlet Extraction Apparatus	1
PED- 5	Nitrogen Cylinder with Regulator	1
PED- 6	Mercury Barometer	1
PED- 10	Fluid Content Stills, Water Cooled	1
PED- 14	Universal Porometer	1
PED- 16	Welch Due Scale Vacuum Pump	2
PED- 17	Vacuum Oven	1
PED- 18	Analytical Balance	2
PED- 40	Automatic Flash Point Tester	1
PED- 41	Automatic Viscosity Measuring System	1
PED- 47	Density /Sp. Gravity Meter	1
PED- 48	Electric Hot Plate	2
PED- 49	Auto Adsorption Balance	1
PED- 50	Gas Meter for Wet Test	1
PED- 51	Gas Meter for Dry Test	1
PED- 52	Precision Planimeter, Digital	1
PED- 54	Variable Speed Electronic Rheometer	1
PED- 55	Resistivity Meter for Mud and Mud Filtrates	1
PED- 59	Interfacial Tensiometer	1
PED- 67	Hydrometer Constant Temperature Bath	1
PED- 68	Test for Sulphur in Petroleum	1
PED- 69	Cloud and Pour Point Apparatus	1
PED- 70	Emulsion Stability Tester	1
PED- 72	Thermostat Oven	1
PED- 73	Electric Pycnometer	1
PED- 76	Personal Computer	3
PED- 78	Plotter	1
PED- 79	Laser Printer	1
PED- 80	Multimedia Projection System	1
PED- 82	Scanner	1
PED- 85	Air Compressor with Reservoir	1
PED- 86	Dean Stark Apparatus	1
PED- 87	Oil and Water Retort Kit	1

Item No.	Name of Equipment	Qty
PEE- 89	Digitizing Table	1
PEE- 90	Gas Chromatograph	1
PEE- 91	Mud Consistometer	1
<b>INSTITUTE OF ENVIRONMENTAL ENGINEERING &amp; RESEARCH</b>		
IEER- 1	Digital pH/Temperature/mV Meter	2
IEER- 2	Dissolved Oxygen Converter	2
IEER- 3	Total Dissolved Solids Meter	1
IEER- 4	Turbidimeter	2
IEER- 6	Miniature Current Flow Meter	1
IEER- 7	Hand Held Suspension Set	1
IEER- 8	Chlorination Test Kit	1
IEER- 10	Water Test Kit	1
IEER- 11	River Water and Quality Test Kit	1
IEER- 13	Vari-Heat Extraction Rack for COD	2
IEER- 14	Incubator	2
IEER- 16	Water Sampler	1
IEER- 17	Portable Water and Hygiene Testing System	1
IEER- 18	Fluoride /pH-Meter	2
IEER- 19	Water Bath Shaker	1
IEER- 25	Flow Meters	1
IEER- 27	Portable Dust Sampler	1
IEER- 28	Smoke Tester	1
IEER- 29	Electronic Precision Balance	2
IEER- 32	Portable Digital Residual Chlorine Meter	1
IEER- 33	Chloride Meter	1
IEER- 34	Conductivity Meter	2
IEER- 35	Sulphur Estimation Apparatus	1
IEER- 36	CO <sub>2</sub> /CO Portable Analyzer	1
IEER- 37	SO <sub>2</sub> Analyzer /Recorder	1
IEER- 41	Flocculation Test Unit	1
IEER- 49	Personal Computer	5
IEER- 50	Dot Matrix Printer	1
IEER- 51	Laser Printer	1
IEER- 53	Analytical Balance	2
IEER- 54	Oven	2
IEER- 55	Vacuum Pump	2
IEER- 56	Incubators	1
IEER- 57	Compound Microscope	2

Item No.	Name of Equipment	Qty
IEER- 58	Water Deionizer	2
IEER- 59	Autoclave	1
IEER- 60	Spectrophotometer	1
IEER- 61	Magnetic Stirrer	2
IEER- 63	Oil-in Water Analysis	1
IEER- 64	Furnace	
a)	Type A (over 1500 deg.)	1
b)	Type B (approx. 1000deg.)	1
<b>ARCHITECTURE DEPARTMENT</b>		
<b>GRAPHICS &amp; PRESENTATION LABORATORY</b>		
AGP- 1	Opaque Projector	1
AGP- 2	Copying Machine	1
AGP- 3	Spray Gun	5
AGP- 4	Overhead Projector	4
AGP- 5	Slide Projector	3
AGP- 6	Screen with Tripod	5
AGP- 7	LCD Panel for OHP	2
<b>PHYSICAL ENVIRONMENT STUDIES LABORATORY</b>		
APE- 1	Digital Luxmeter	2
APE- 2	Precision Integrating Sound Level Meter	2
APE- 3	Random Noise Generator	1
APE- 4	Speaker	2
APE- 6	Vane Anemometer	5
APE- 7	Top Loading Balance	2
APE- 9	Hand Held Relative Humidity Temperature Meter	5
APE- 10	Temperature/Humidity Recorder	2
APE- 11	Hand Held Infrared Thermometer	5
<b>PHOTOGRAPHIC DEVELOPING &amp; PRINTING LABORATORY</b>		
APP- 2	Ammonia (white) Printing Machine	1
APP- 3	Photo Copying Machine (Large Size)	1
APP- 4	SLR Camera with Zoom/Close-up Lenses	1
APP- 5	Video Camera with VCR	2
APP- 6	Video Monitor Set	2
<b>SURVEYING LABORATORY</b>		
ASL- 3	Planimeter	1
ASL- 4	Auto Level	5
ASL- 5	Contour Enlarger	1
ASL- 6	Distomat	1

Item No.	Name of Equipment	Qty
ASL- 7	Drafting Machine	5
<b>COMPUTERS &amp; PERIPHERALS</b>		
ACP- 1	Personal Computer	5
ACP- 2	Dot matrix Printer	1
ACP- 3	Laser Printer	1
ACP- 4	Color Plotter (Large)	1
<b>CITY &amp; REGIONAL PLANNING DEPARTMENT</b>		
<b>DRAWING &amp; DATA ANALYSIS LABORATORY</b>		
RPD- 1	Photocopying Machine	1
RPD- 2	Digital Planimeter	5
RPD- 3	Drafting Machine	5
RPD- 4	Personal Computer	5
RPD- 5	Dot Matrix Printer	1
RPD- 6	Laser Printer	1
RPD- 7	Color Plotter	1
RPD- 8	Scanner	1
RPD- 9	Overhead Projector	4
RPD- 10	LCD Panel	2
RPD- 11	Slide Projector	2
RPD- 12	Pentagraph Enlarger and Reducer	1
RPD- 13	Sound Level Meter	4
RPD- 14	Fluid Gas Analyzer	1
RPD- 16	Opaque Projector	2
<b>COMPUTER SCIENCE DEPARTMENT</b>		
CSD- 1	Computer	20
CSD- 2	Fileserver	1
CSD- 3	Fileserver	1
CSD- 4	Workstations	20
CSD- 5	LAN System	2
CSD- 6	Printers	
	a) Laser Printer	1
	c) Dot Matrix Printers	6
CSD- 8	UPS (6 kVA)	2
<b>MATHEMATICS DEPARTMENT</b>		
BAM- 1	Compound Pendulum	2
BAM- 2	Screw Jack	2
BAM- 3	Inclined Plane	2
BAM- 4	Fly Wheel	2

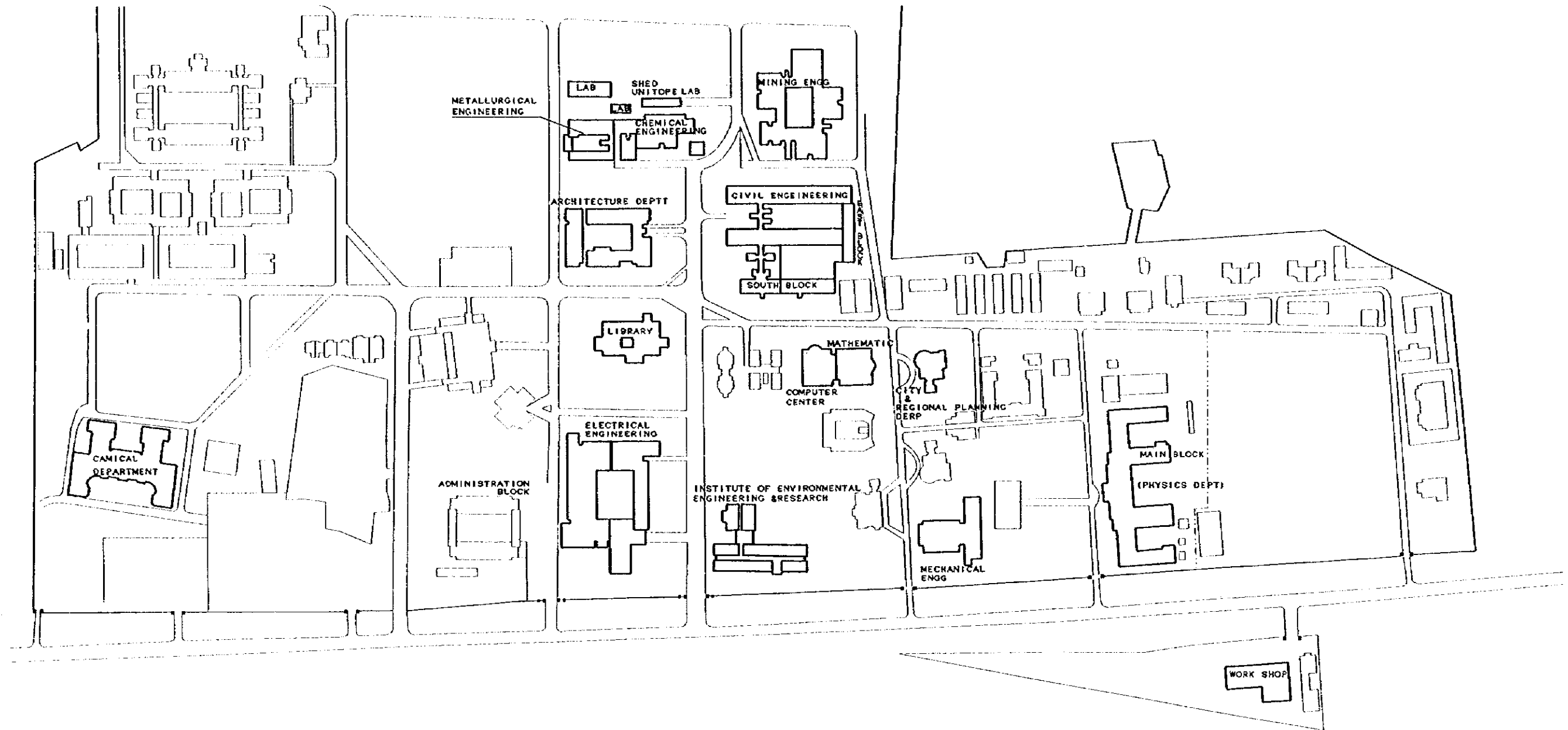
Item No.	Name of Equipment	Qty
BAM- 5	Bending Moments	2
BAM- 8	Simple Roof Truss	2
BAM- 9	Jib Crane	2
BAM- 10	Loaded Beam Assembly	2
BAM- 11	'g' by Free Fall Apparatus	2
BAM- 12	Compression of the Spring	2
BAM- 13	Worm and Worm Wheel	2
BAM- 14	Fletcher's Trolley	2
BAM- 15	Apparatus Having Square and V-Thread	2
BAM- 16	Bent Lever	2
BAM- 17	Forces Acting at a Point Assemble	2
BAM- 19	Sliding Friction Assembly	2
BAM- 21	Young's Modules Apparatus	2
BAM- 23	Polygon of Forces Conversion Set	2
BAM- 24	Differential Pulley Apparatus	2
BAM- 25	Law of Moment Apparatus	2
BAM- 26	Maxwell's Needle	2
BAM- 28	Vernier Caliper	2
BAM- 29	Screw Gauge	2
<b>CHEMISTRY DEPARTMENT</b>		
BCH- 1	Water Distillation Unit	1
BCH- 4	Single Pan Top Loading Electronic Balance	1
BCH- 5	Digital Conductivity Meter	1
BCH- 6	Digital pH Meter	1
BCH- 8	Oxygen Meter	1
BCH- 10	Hot Plate	1
BCH- 11	Kjeldahl Nitrogen Apparatus Analyzer Digest /Automatic System	1
BCH- 12	Centrifuge Basket Type	1
BCH- 13	Potentiometric Automatic Titrator	1
BCH- 14	Refractometer	1
BCH- 15	Gas Chromatograph	1
BCH- 16	Potentiostat	1
BCH- 17	Electric Furnace	1
BCH- 18	Electric Oven	2
BCH- 19	UV-Visible Spectrophotometer	1
BCH- 20	Overhead Projector	1
BCH- 21	Quickfit Assembly	2
BCH- 22	Electric Water Bath	2

Item No.	Name of Equipment	Qty
BCH- 23	Apparatus for T.C Plates Preparation	1
BCH- 24	Ultrasonic Bath	1
BCH- 25	Heating Mantles (250ml, 500ml, 1l)	2
<b>PHYSICS DEPARTMENT</b>		
BPH- 1	X-Y Recorder	1
BPH- 2	Digital Storage Oscilloscope	1
BPH- 3	Oscilloscope Dual Trace	1
BPH- 4	Digital Multimeter	1
BPH- 5	Helium-Neon Laser Optics	1
BPH- 6	High Voltage DC Power Supply	1
BPH- 7	Lock in Amplifier	1
BPH- 8	Spectrometer with Accessories	1
BPH- 9	Diffusion Pump	1
BPH- 13	Ionization Current Measurement	1
BPH- 14	Travelling Microscope	1
BPH- 15	Signal Counter (Frequency Counter)	1
BPH- 16	Spectrum Analyzers	1
BPH- 17	Apparatus for Measurement of Magnetic Field outside a Straight Conductor	2
BPH- 18	Apparatus for Measurement of Electric Fields and Potentials in the Plate Capacitor	2
BPH- 19	Power Supply	3
BPH- 20	Ballistic Galvanometer	6
BPH- 21	Regulated Power Supply	3
BPH- 22	Regulated Power Supply DC (0-30V, 60mA)	3
BPH- 23	Regulated Power Supply DC (0-25V, 60mA)	8
BPH- 24	Regulated Power Supply Outputs	3
BPH- 25	Regulated Power Supply (Dual, +/-15V)	1
BPH- 26	Regulated Power Supply (Dual, +/-25V)	1
BPH- 27	Overhead Projector with Screen	1
BPH- 29	Digital Sound Level Meter	1
<b>WORKSHOP EQUIPMENT</b>		
WSE- 8	TIG Welder	1
WSE- 9	MIG Welder	1
WSE- 10	Wooden Planer Machine	1
WSE- 11	Bench Grinding Machine	1
WSE- 14	Shear Machine	1
WSE- 16	Press Forging Machine	1
WSE- 17	Measurement Instruments (Vernier Calipers, Micrometer & Gauges)	6
WSE- 21	Optical Pyrometer	1

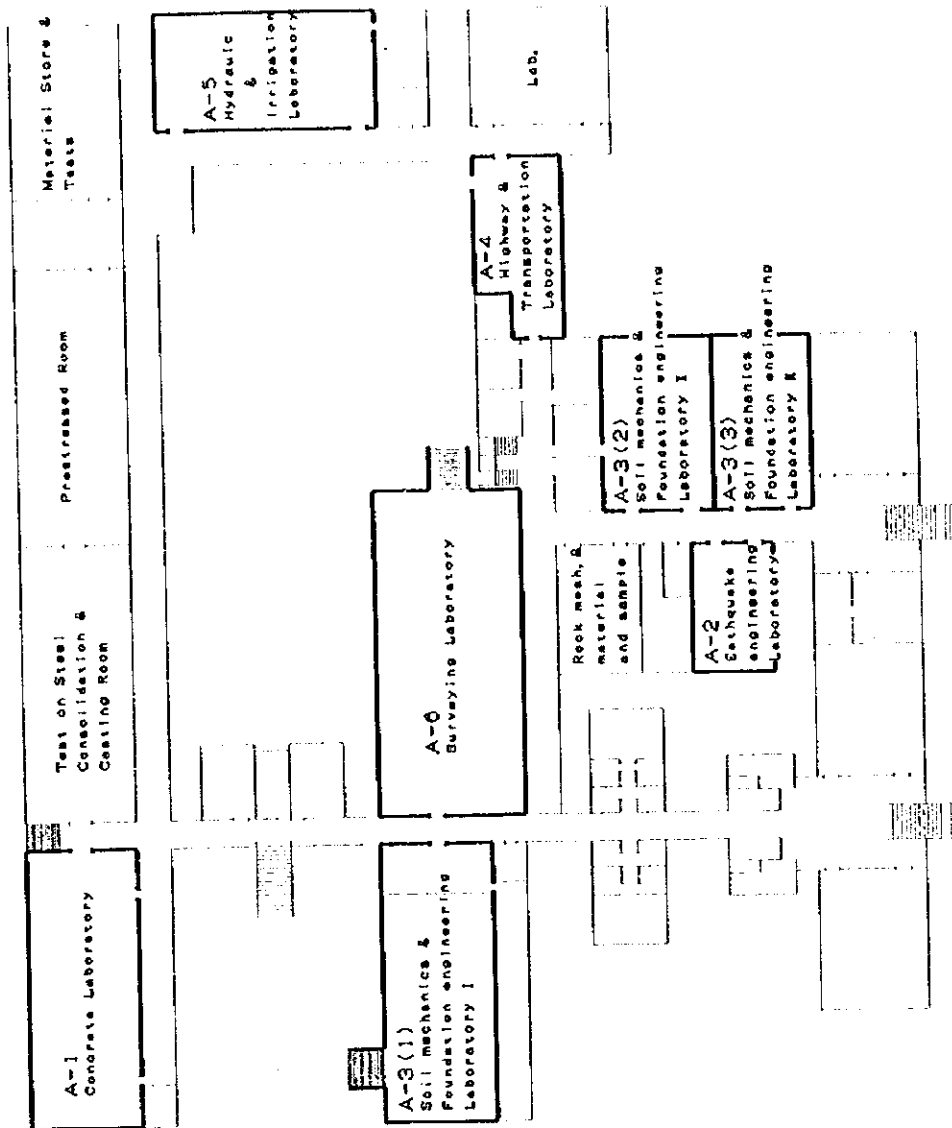
Item No.	Name of Equipment	Qty
WSE- 22	Luxmeter	1
WSE- 24	Tachometer	2
WSE- 25	Sound Level Meter	1
WSE- 28	Leakage Current Tester	1
WSE- 30	Earth Tester	1
WSE- 31	Insulation Oil Tester	1
WSE- 34	Electric Hand Tools	1
WSE- 35	Wankel Engine Model	1
WSE- 36	Steering Model	1
WSE- 37	Hydraulic-Pneumatic Braking System	1
WSE- 38	Diesel Injection Pump	1
WSE- 39	Turbo Supercharged Diesel Engine	1
WSE- 40	Petrol Engine Model	1
WSE- 42	Twin Overhead Camshaft Petrol Engine	1
WSE- 43	Petrol Engine Clutch & Gearbox	1
<b>LIBRARY</b>		
YIB- 1	Overhead Projector	1
YIB- 2	Slide Projector	1
YIB- 4	Screen, Wall Mounting	1
YIB- 5	Tripod Screen	2
YIB- 7	Video Cassette Recorder	1
YIB- 8	Colour T.V.	1
YIB- 12	Photo Copiers	5
YIB- 15	35mm Still Camera	2
YIB- 17	Slide Video Converter	1
YIB- 18	Overhead Camera	1
YIB- 19	AV-Selector	1
YIB- 20	Sound Mixer	1
YIB- 21	Video Projector	1
YIB- 22	Amplifier	1
YIB- 23	Microphone with Stand	2
YIB- 24	Speaker System	2



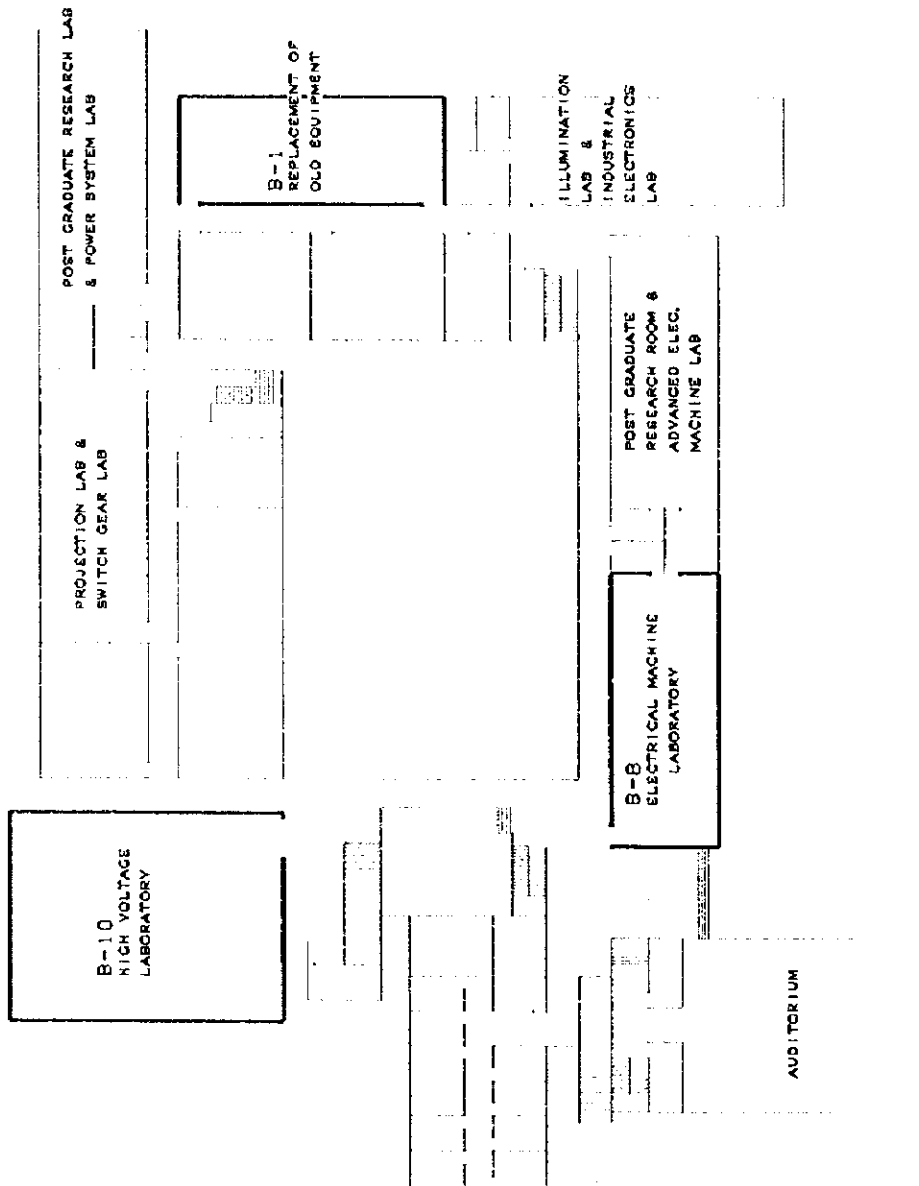
APPENDIX - 7 LAYOUT PLAN



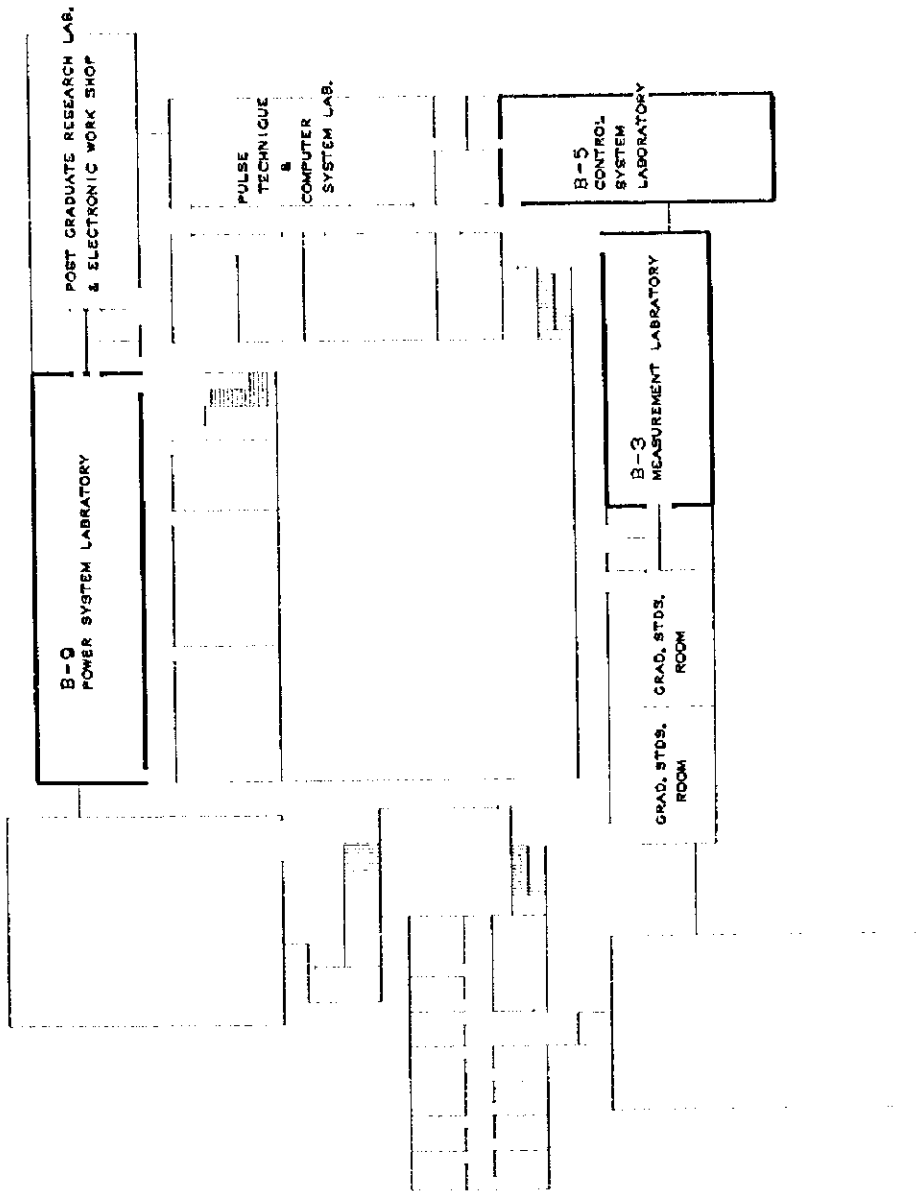




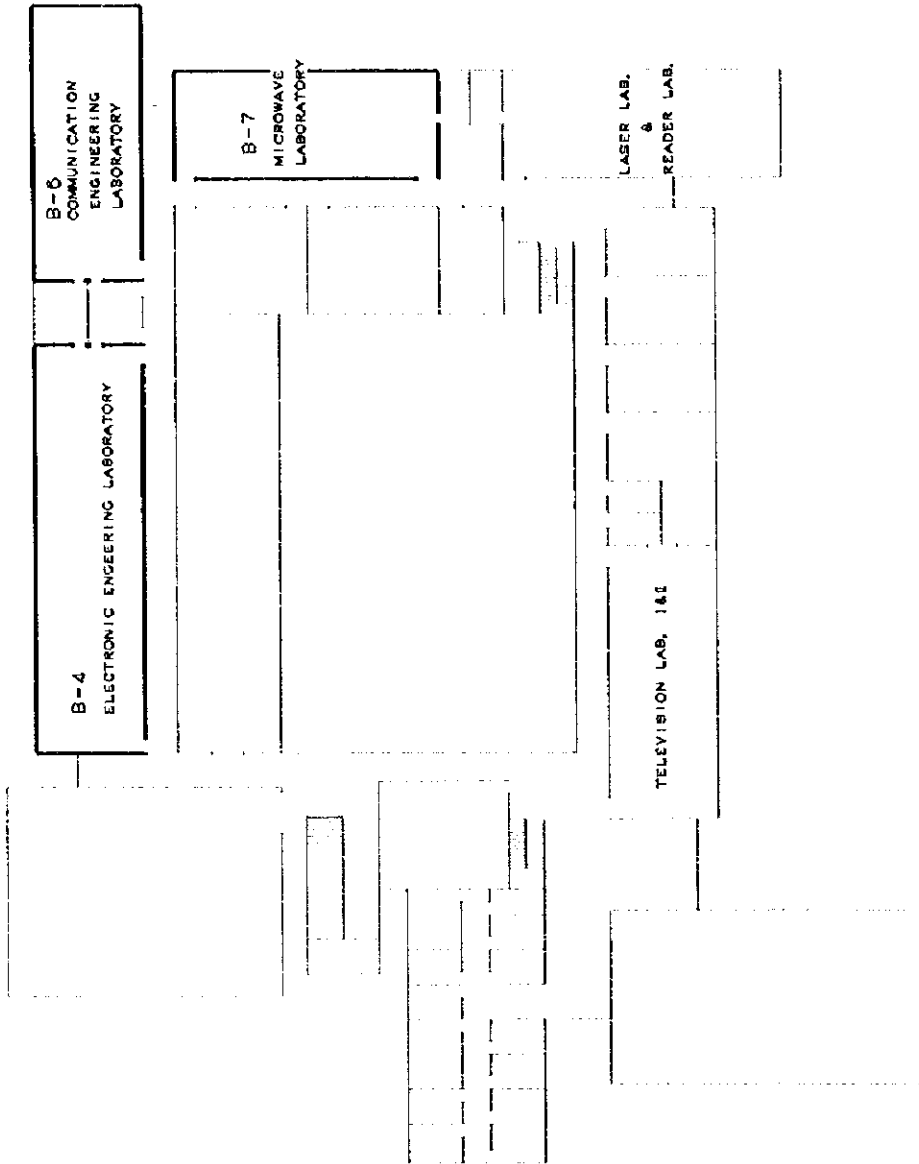
CIVIL ENGINEERING DEPTT.  
GROUND FLOOR



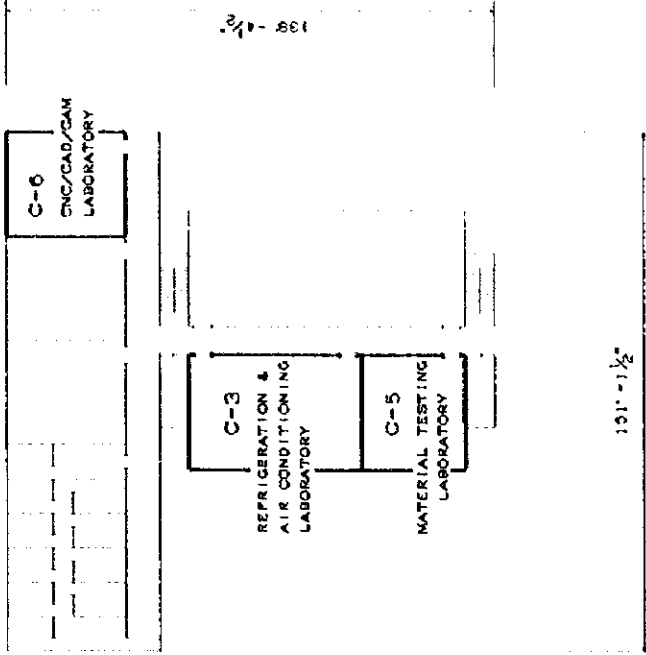
ELECTRICAL ENGINEERING DEPARTMENT  
GROUND FLOOR



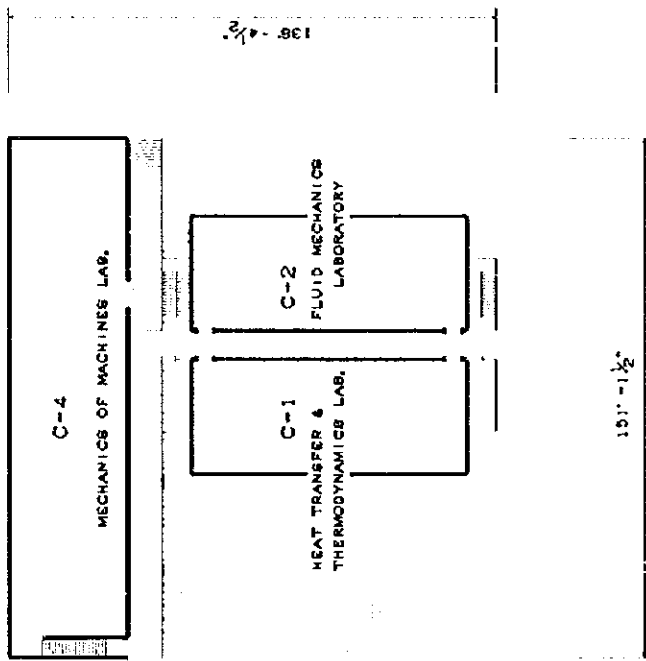
ELECTRICAL ENGINEERING DEPARTMENT  
FIRST FLOOR



ELECTRICAL ENGINEERING DEPARTMENT  
SECOND FLOOR

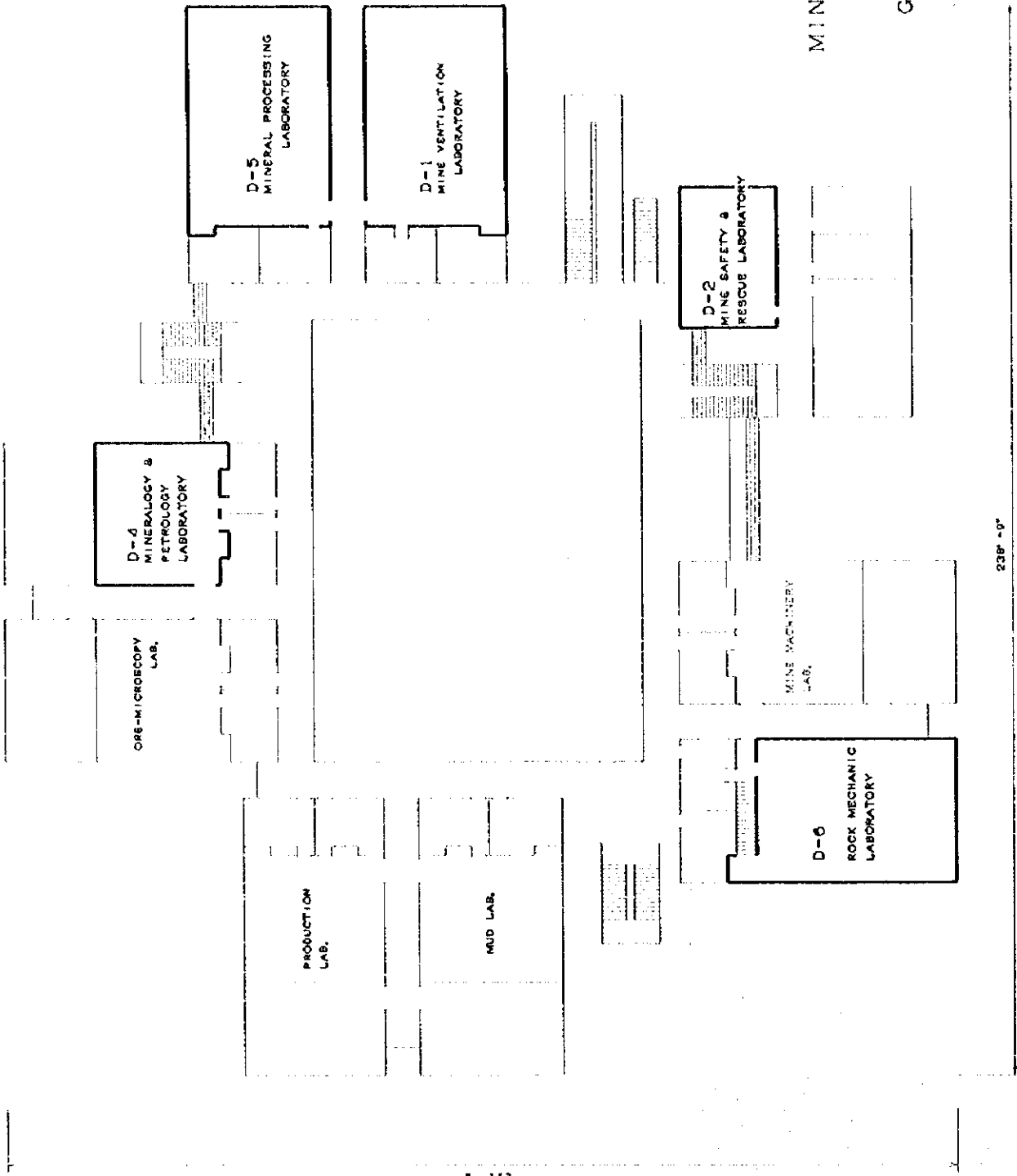


FIRST FLOOR



GROUND FLOOR

MECHANICAL ENGINEERING DEPARTMENT



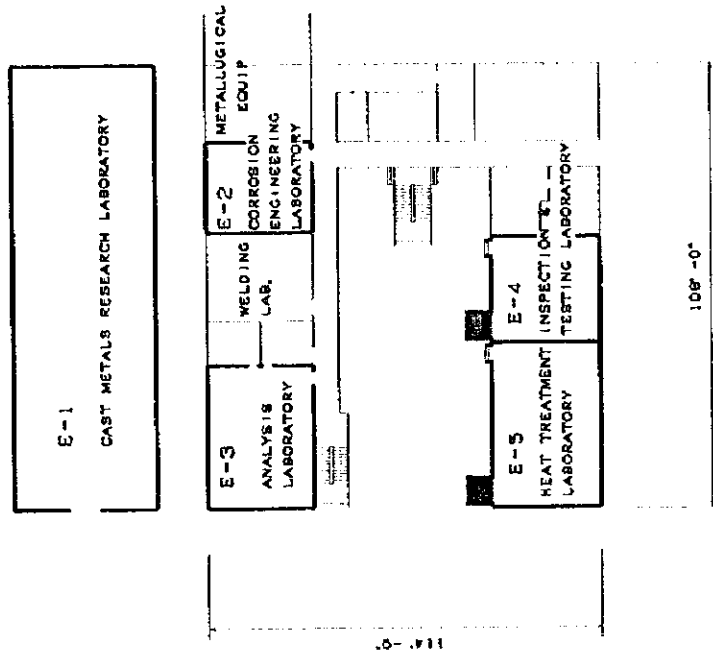
5-112

A-7-7

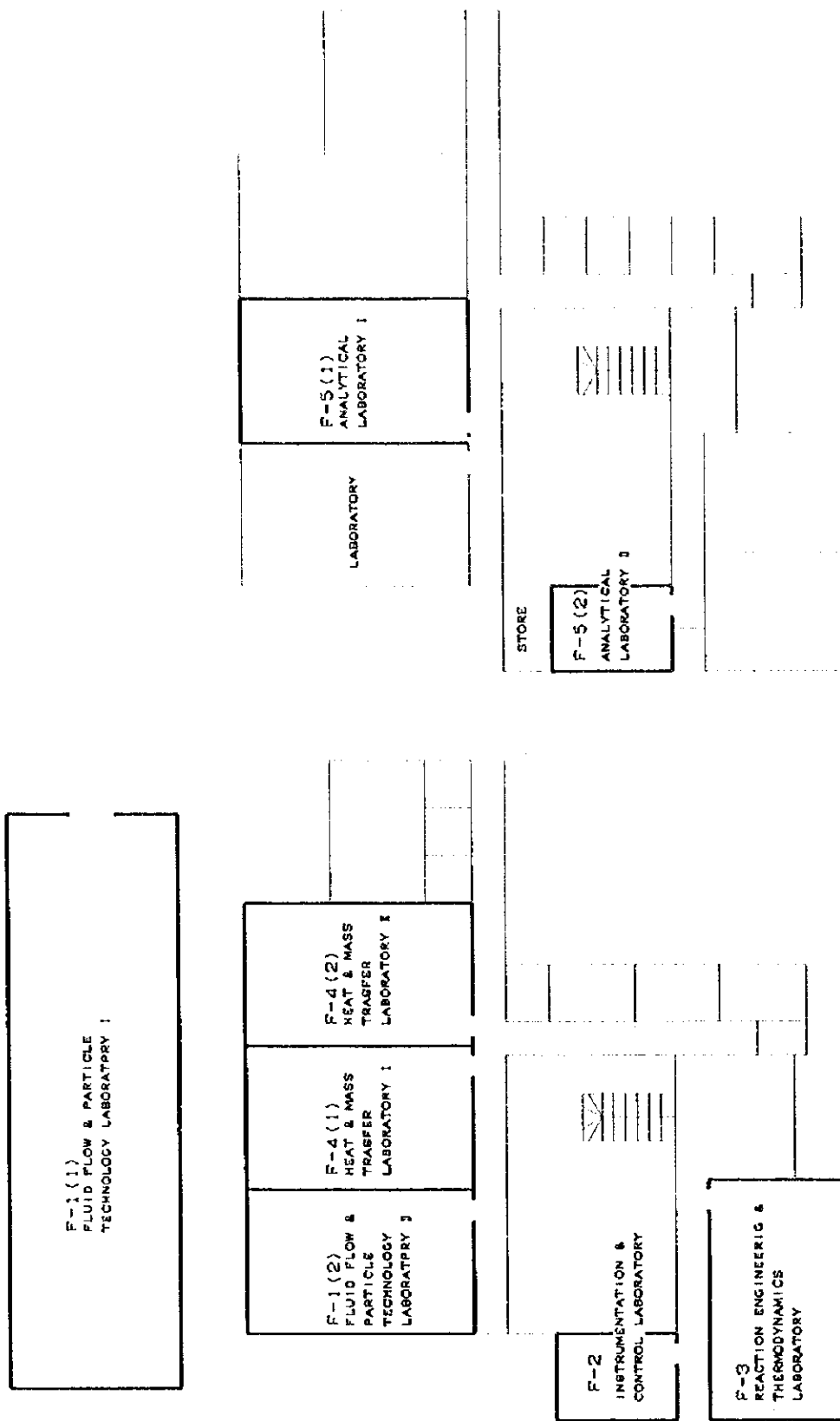
MINING ENGINEERING  
DEPARTMENT  
GROUND FLOOR

238' x 9"





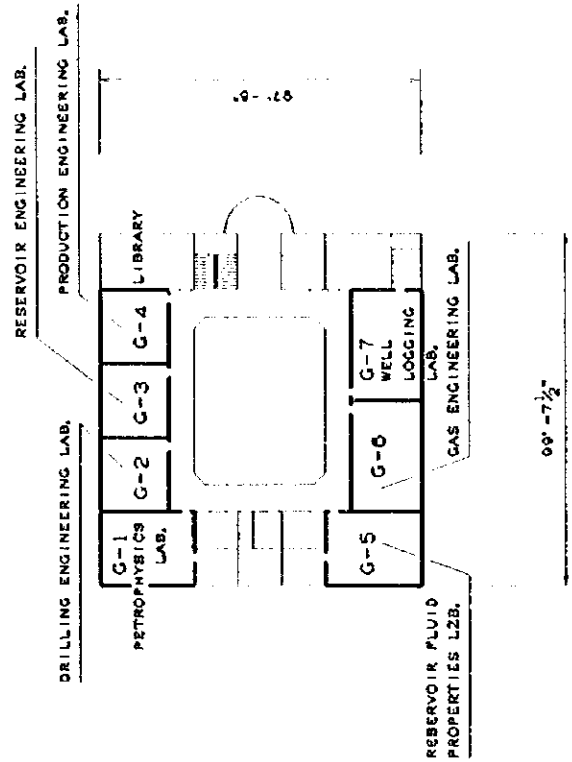
METALLURGICAL ENGINEERING &  
 MATERIAL SCIENCES DEPARTMENT  
 GROUND FLOOR



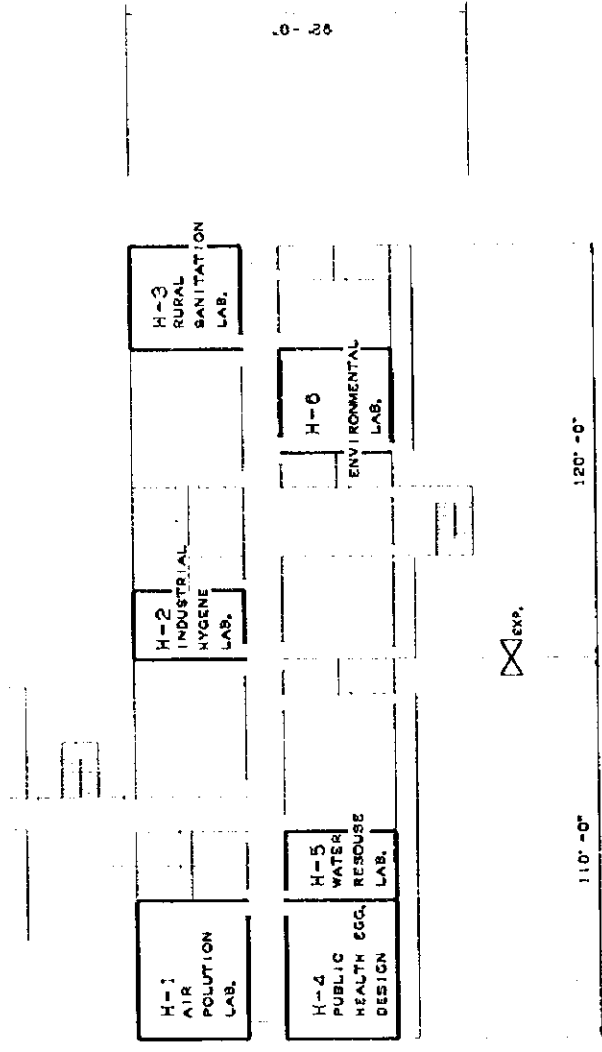
GROUND FLOOR

FIRST FLOOR

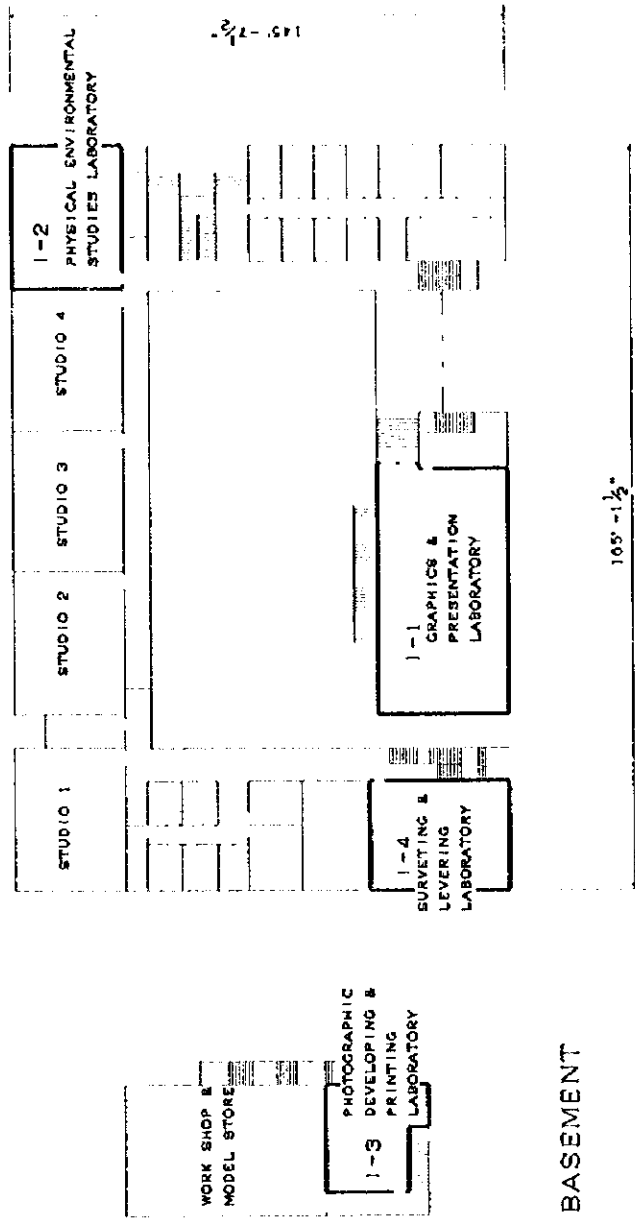
CHEMICAL ENGINEERING DEPARTMENT



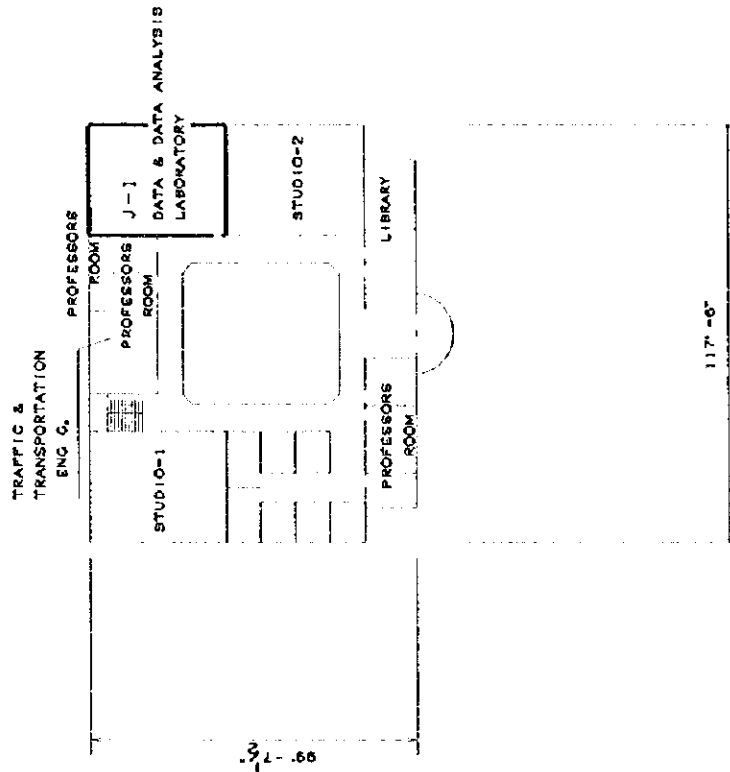
PETROLEUM ENGINEERING DEPARTMENT  
 GROUND FLOOR



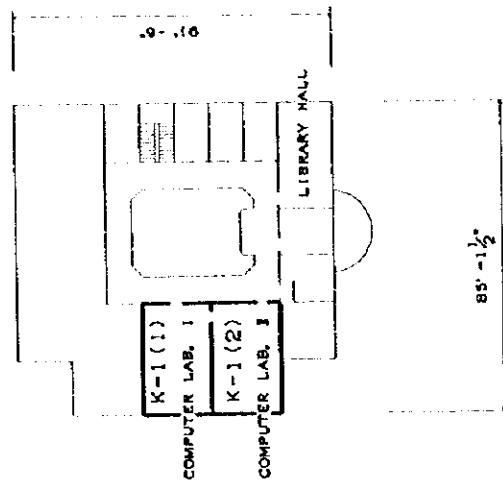
INSTITUTE OF  
ENVIRONMENTAL ENGG.  
& RESEARCH  
GROUND FLOOR



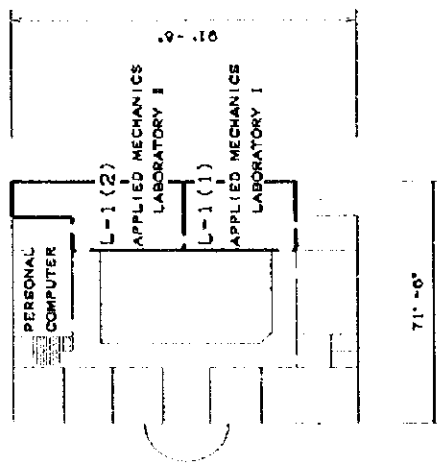
ARCHITECTURE DEPARTMENT  
GROUND FLOOR



CITY & REGIONAL  
PLANNING DEPARTMENT  
GROUND FLOOR

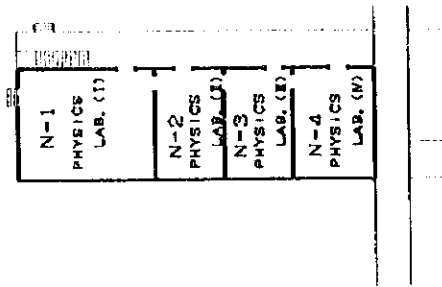


COMPUTER SCIENCE DEPARTMENT  
FIRST FLOOR

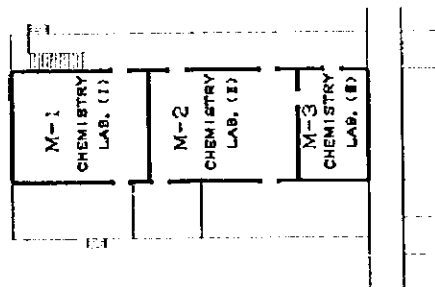


MATHEMATICS DEPARTMENT  
GROUND FLOOR





PHYSICS DEPARTMENT  
GROUND FLOOR



CHEMISTRY DEPARTMENT  
GROUND FLOOR

26-02

WORKSHOP

67-1 1/2\*

WORKSHOP  
GROUND FLOOR







JICA