

2.4 Background and Contents of the Request

(1) Background

The construction of the main facilities of the present JKUCAT commenced in March 1979 with the grant aid assistance of the Government of Japan and was completed in 1981. These facilities consist of the common lecture building, laboratory building and workshop building of the Faculty of Agriculture, the laboratory building and workshop building of the Faculty of Engineering, an assembly hall, administration building, welfare facilities and student accommodations, etc.

Additional grant aid assistance was provided in February 1987 for the construction of a farm, farm management building, storage pond and farming equipment building, with which the total floor area became 33,872m².

JKCAT (present JKUCAT) was opened in May 1981 with the purpose of training middle level engineers equipped with appropriate technical skills to contribute to the socio-economic development of Kenya using the above facilities and coupled with Japan's technical cooperation which commenced in April, 1980. The Faculty of Agriculture has been providing 3-year diploma courses while the Faculty of Engineering has been providing technician training courses of 4 years and 3 months. The technical cooperation has now been extended to April 1990 in view of the further consolidation of its achievements.

While JKUCAT is rated on a par with such technical colleges as Kenya Polytechnic Nairobi and Mombasa Polytechnic, its high national examination passing rate proves the exceptionally high quality of its graduates.

The new educational system (stressing equal educational and technical educational opportunities) and the annual population increase of 4% have resulted in a rapid increase of high school (secondary school) leavers with the necessary qualifications for university entrance and, therefore, the existing universities are under strong pressure to expand their facilities.

Against this background, JKUCAT, which specializes in agriculture and engineering and which already provides high level technical education, can make a major contribution to the development of Kenya, where natural resources and land are essential resources and agriculture is the mainstay of

the economy, by sending into Kenyan society graduates who are fully equipped with the necessary theoretical knowledge and technical skills.

It has often been pointed out that the existing universities tend to be biased towards theories. JKUCAT is possibly the only educational institution in Kenya which provides both strong theoretical and technical education.

Based on the understanding that the expansion of JKUCAT's facilities and the strengthening of its teaching staff will contribute to the stability and development of Kenya, the Government of Kenya formally decided to upgrade JKUCAT to full university status in July, 1988 and subsequently requested the Government of Japan's provision of new grant aid assistance and the continuation of its technical cooperation.

In response to this request, the Government of Japan sent the Consultation Team and Preliminary Study Team to Kenya in August 1988 to examine the appropriateness of the contents of the request. On the Kenyan side, it was announced that JKUCAT would become a constituent college of Kenyatta University on September 1, 1988.

(2) JKUCAT Master Plan

Taking the opportunity of its upgrading to a constituent college, JKUCAT reviewed the original Master Plan and prepared the Revised Master Plan with a target completion year of 1999/2000.

the work plan and facility expansion plan under the Revised Master Plan are as follows (refer to Summary of JKUCAT Development Plan; 1995/96 - 1999/2000).

1) Expansion of Work Plan

New bachelor degree courses and HND courses will be introduced in both the Faculties of Agriculture and Engineering and master degree courses will commence in 1998/99. New Faculties of Science and Social Science will be established when the existing OD courses finish in 1995/96.

2) New Facilities

The expansion or construction of the following facilities is planned with the introduction of the new courses and Faculties described above.

■ Summary of JKUCAT Development Plan (1995/96~1999/2000)

(Person)

Course \ Year	1995/96	1996/97	1997/98	1998/99	1999/2000
Higher National Diploma Course					
Architecture	80	80	40		
Electrical and Electronics	80	80	40		
Mechanical Engineering	80	80	40		
Sub Total	240	240	120		
Bachelor Course					
Horticulture	180	200	220	240	240
Agricultural Engineering	180	200	220	240	240
Food Technology	90	100	110	120	120
Post-harvest Technology	90	100	110	120	120
Civil and *Architecture	200	240	280	320	320
*Electrical and Electronics	60	120	180	240	240
*Mechanical Engineering	40	80	120	160	160
*Sciences	200	400	600	800	800
Sub Total	1,040	1,440	1,840	2,240	2,240
Total (Bachelor & HND)	1,280	1,680	1,960	2,240	2,240
*Master Course (Agri. & Engi.)				40	80
Ordinary Diploma	328	164			
Grand Total	1,608	1,844	1,960	2,280	2,320

1995/96 to 1999/2000 : Future planning presented by JKUCAT

Remarks : * New Course

(3) Contents of Request

Based on the Revised JKUCAT Master Plan, the Government of Kenya prepared JKUCAT Expansion Project with a target year of 1994/95 and requested the Government of Japan's provision of grant aid assistance for the Project. The requested facilities and equipment are as follows.

1) Educational Facilities

- Laboratories
- Lecture Rooms
- Water Purification Plant
- Workshops
- Lecturers' Rooms
- Library
- Resource Centre
- Teaching Equipment
- Others

2) Administration Building and Maintenance Workshop

3) Student Accommodations and Canteen

The sizes and contents of the requested facilities and equipment are based on the requirements of the target year of 1994/95 and a population of 1,372 students. Eight newly introduced courses will include 4 bachelor degree courses in Horticulture, Agricultural Engineering, Food Technology and Postharvest Technology in the case of the Faculty of Agriculture, a bachelor degree course in Civil Engineering in the case of the Faculty of Engineering and 3 HND courses in Architecture, Electrical and Electronic Engineering and Mechanical Engineering. The Horticulture course will commence in 1989/90 while all other new courses will commence in 1990/91. (refer to Summary of JKUCAT Development Plan; 1989/89 - 1994/95).

■ Summary of JKUCAT Development Plan (1988/89~1994/95)

Course	Year						
	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95
(Person)							
<u>Higher National Diploma Course</u>							
Architecture			40	80	80	80	80
Electrical and Electronics			40	80	80	80	80
Mechanical Engineering			40	80	80	80	80
Sub Total			120	240	240	240	240
<u>Bachelor Course</u>							
Horticulture		40	80	120	160	160	160
Agricultural Engineering			40	80	120	160	160
Food Technology			20	40	60	80	80
Post-harvest Technology			20	40	60	80	80
Civil Engineering			40	80	120	160	160
Sub Total		40	200	360	520	640	640
Total (Bachelor & HND)		40	320	600	760	880	880
Ordinary Diploma	270	282	360	436	492	492	492
Technician	416	416	312	208	104		
Grand Total	686	738	992	1,244	1,356	1,372	1,372

Upto 1994/95 : Figures according to the Minutes dated 24 Jan. 1989

CHAPTER 3 CONTENTS OF THE PROJECT

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3.1 Objectives

As already described in Chapter 2, the number of applicants to higher educational institutions has been rapidly increasing due to the introduction of the new educational system (8-4-4) in 1984 and the conspicuous population increase in recent years. The expansion of university education is urgently required not only to accommodate the increased number of applicants but also to satisfy the social requirements for graduates with high-level technical abilities.

The Government of Kenya has, therefore, decided to upgrade and expand JKCAT to JKUCAT as a constituent college of Kenyatta University as part of its policy to substantially expand the facilities of the existing universities and has prepared a facility expansion plan for JKUCAT. The present Project aims at the construction of the facilities and the provision of the equipment required for the implementation of this plan.

3.2 Examination of Requested Contents

3.2.1 Appropriateness and Necessity of the Project

The purpose of the Project is the construction of the facilities and the provision of the equipment required to implement the expansion plan following JKCAT's upgrading to JKUCAT as described earlier. The appropriateness and necessity of the Project are examined here taking the following aims of the Project into consideration.

- **Qualitative Improvement of Education**

Qualitative improvement of teaching staff, expansion of facilities and provision/consolidation of teaching equipment to enable university level education in the fields of agricultural science and engineering.

- **Consolidation of University Basis**

Consolidation of the university basis under the Project in view of the future upgrading of JKUCAT to an independent university to assist the full implementation of the Master Plan of the Kenyan side.

◦ Fostering of Manpower to Contribute to Socioeconomic Development

Fostering of manpower equipped with thorough theoretical knowledge and technical skills to contribute to the socio-economic development of Kenya by means of consolidating JKUCAT as a university, the strength of which will lie in its provision of both theoretical and technical education pursuant to the spirit of the new educational system.

(1) Qualitative Improvement of Education

It is often said that the best education begins with capable teachers and a qualitative improvement of education based on capable teaching staff is of crucial importance for the Project.

The Faculties of Agriculture and Engineering currently provide diploma courses and technician courses, respectively. With the upgrading to university status, the teaching level and academic qualifications of the teaching staff should be accordingly upgraded. Teachers of bachelor degree courses will be required to possess at least a master's degree while those for HND and OD courses will be required to have at least a bachelor's degree.

JKCAT struggled long and hard in the past to secure the necessary teaching staff and to raise their qualifications in order to improve its staffing situation which was inferior to that of other higher educational institutions. The general shortage of teachers of technical subjects in Kenya and the low pay scale due to JKCAT being under the control of the TSC, however, often led those teachers who obtained their master's degrees in Japan to leave JKCAT for better positions elsewhere. While the teaching staff shortage will be alleviated to a certain extent by the improvement of the pay scale and social status of teachers at the upgraded JKUCAT, efforts to recruit teachers with the right qualifications are strongly required on the Kenyan side for JKUCAT's future development.

The Kenyan side currently plans to increase the teaching staff of JKUCAT. However, since expansion projects are also beginning to take shape at other universities, including Kenyatta University and Egerton University, there may be strong competition between universities which are under strong

pressure to increase their recruitment of new teaching staff. Therefore, JKUCAT intends to train new teachers by sending its existing teachers and newly recruited teachers holding bachelor's degrees to obtain their master's or higher degrees abroad rather than relying on new recruits with higher degrees (master's degrees and doctorates) (see tables showing Teaching Staff Recruitment Plan and other similar plans).

Japanese cooperation for this staff upgrading is strongly hoped for. As the training program presented by the Kenyan side has already been revised on the basis of the past performance, the present program appears both realistic and feasible. The revised number of trainees to be accepted annually in Japan on Ministry of Education scholarship is 4, while there will be 4 for the Third Training Program and 10 will study at other universities in Kenya. In addition, the following cooperation measures are suggested for Japan to assist manpower development in Kenya to educate the necessary teaching staff for the future JKUCAT.

- 1) Provide newly recruited B.Sc holders with financial assistance to enroll in Master's degree courses at the University of Nairobi and earn M.Sc. The educational expenses will be half a million yen per year per person, and those awarded the grant will attend their respective courses to earn the required credits in the first year, and write their thesis in the second and third years at JKUCAT.
- 2) Have the B.Sc holders earn M.Sc degree and the M.Sc holders earn Ph.D through the Japan's Ministry of Education Scholarship or the Third Country Training Program.
Dispatch HND holders to Japan as JICA trainees, and provide the young ones with good academic results with an opportunity to enroll in a graduate school on a Japan's Ministry of Education Scholarship to earn M.Sc on a continuous basis.
- 3) Merititious JKUCAT graduates will be recruited as technicians and will study for their B.Sc in third countries.

While measure 1) above can be easily implemented once the financial requirements are met, measure 2) involves various problems, including (i) the number of students awarded a Ministry of Education scholarship is limited and (ii) the M.Sc obtained in Japan by those trainees holding the Kenyan HND may not be accepted in Kenya as the intermediate degree (i.e., B.Sc) is lacking.

Measure 3) is already in progress with positive results in the Department of Building and Civil Engineering.

TEACHING STAFF DEVELOPMENT PLAN (1988/89~1994/95)

Faculty / Dept.	1988/89 (Present)	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95
Agri.							
Horticulture	11+(2)	15+(1)	16+(3)	16+(6)	19+(5)	22+(4)	24+(3)
Agri. Engineering	10+(6)	12+(6)	14+(7)	18+(7)	19+(6)	22+(5)	23+(4)
Food Technology (Includ. Post Harvest)	5+(2)	7+(5)	11+(6)	16+(6)	20+(7)	23+(8)	28+(6)
Farm Management	1	2	2	4	4	4	4
Engi.							
Building & Civil Engineering Architecture	19+(6)	11+(5) 9+(4)	14+(5) 10+(4)	16+(5) 13+(2)	20+(2) 13+(3)	20+(2) 14+(2)	19+(3) 13+(3)
Mechanical	16+(2)	16+(5)	18+(7)	22+(4)	21+(6)	21+(6)	22+(5)
Electrical & Electronic	15+(4)	16+(6)	17+(7)	20+(5)	20+(6)	22+(5)	21+(6)
Common							
Mathmatic & Science	7+(1)	9+(1)	13+(1)	16+(2)	20+(2)	22+(3)	24+(4)
Social Science	4	6	11	14	16+(1)	17+(2)	18+(2)
Grand Total	88+(23) =111	103+(33) =136	126+(40) =166	153+(37) =190	172+(38) =210	187+(37) =224	196+(36) =232

() : Under Training

■ TEACHING STAFF RECRUITMENT PLAN (1989/90~1994/95)

(Person)

Faculty / Dept. Clarify	Year																							
	1989/90			1990/91			1991/92			1992/93			1993/94			1994/95								
	B	M	D	T	B	M	D	T	B	M	D	T	B	M	D	T	B	M	D	T				
Agri.																								
Horticulture	2	1	3	3	1	2	3	1	1	3	1	2	3	1	1	3	1	2	2	1	1	2	1	1
Agri. Engineering	1	1	2	2	2	1	3	2	-	2	2	-	2	2	-	2	2	-	2	2	-	-	-	-
Food Technology (includ. Post Harvest)	2	3	5	2	2	1	5	3	2	5	3	2	5	3	2	4	2	2	4	3	2	4	3	3
Farm Management	1	-	-	-	-	-	-	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Engi.																								
Building & Civil Engineering	1	-	1	2	2	1	3	2	-	2	1	-	2	1	-	1	-	-	1	-	-	-	-	-
Architecture	1	1	-	2	1	-	1	1	-	1	1	-	1	1	-	1	-	-	1	-	-	-	-	-
Mechanical	2	1	-	3	4	-	4	1	-	1	1	-	1	1	-	1	-	-	1	-	-	-	-	-
Electrical & Electronic	2	1	-	-	2	-	2	1	-	1	1	-	1	1	-	1	1	-	1	1	-	1	-	-
Common																								
Mathmatic & Science	-	2	-	2	-	3	1	4	3	1	4	1	1	4	2	1	4	1	3	1	2	3	1	2
Social Science	-	2	-	2	-	4	1	5	2	1	3	-	3	-	-	3	-	-	2	-	1	2	-	1
Grand Total	9	13	3	25	13	13	4	30	9	2	24	10	7	3	20	7	3	20	14	4	4	14	4	4

Remarks: B : Bachelor, M : Master, D : Doctor, T : Total

Total No. of Teaching Staff Recruitment (1989/90~1994/95) : 121 persons

■ NUMBER OF TEACHING STAFF AT 1994/95

(Person)

Faculty/Development	Teaching Staff	Non Teaching Staff		Sub Total
		Technician	Others	
Agri.				
Faculty Office			5	5
Horticulture	24+(3)	8	18	50+(3)
Agri. Engineering	23+(4)	10	20	53+(4)
Food Technology	28+(6)	9	14	51+(6)
Post Harvest.			10	10
Farm Management	4	8	-	12
Engi.				
Faculty Office			5	5
Building & Civil Engineering	19+(3)	8	16	43+(3)
Architecture	13+(3)	4	10	27+(3)
Mechanical Engineering	22+(5)	10	20	52+(5)
Electrical & Electronic Engineering	21+(6)	10	22	53+(6)
Common				
Mathmatic & Science	24+(4)	6	26	56+(4)
Social Science	18+(2)	3	20	41+(2)
Grand Total	196+(36)	76	186	438+(36)

() : Staff No. of undertraining

(2) Consolidation of University Basis

According to JKUCAT Master Plan prepared by the Kenyan side, the consolidation of teaching courses with a view to becoming an independent university in the future will be conducted in accordance with the following phases (see tables showing the list of courses and number of students):

- First Phase (1988/89 - 1989/90)

This is considered the preparatory phase for the introduction of the HND and bachelor degree courses based on the existing OD courses in the Faculty of Agriculture and technician courses in the Faculty of Engineering. The technician courses of the Faculty of Engineering will stop accepting new admissions in fiscal 1989/90 and will be switched to the OD courses thereafter. The first bachelor degree course (3-year course under the old system) will commence in the Department of Horticulture in September 1989. As the number of students in this phase will be approximately 728, no problems are anticipated in terms of facilities and the efficient use of the existing facilities.

- Second Phase (1990/91 - 1991/92)

Four year bachelor degree courses under the new system will commence in 1990/91 and will be the Agricultural Engineering, Food Technology and Postharvest Technology Courses in the case of the Faculty of Agriculture and the Civil Engineering Course in the case of the Faculty of Engineering. In addition, 7 HND courses consisting of the Architectural Engineering Course and 3 courses each for Electrical and Electronic Engineering and Mechanical Engineering will also commence.

The number of students will be 992 in 1990/91 and 1,244 in 1991/1992, exceeding the capacity of the present facilities. The facility expansion must, therefore, be completed prior to the commencement of this phase.

- Third Phase (1992/93 - 1994/95)

Technician courses of the Faculty of Engineering will be terminated in 1992/93. OD courses will stop accepting new admissions in 1994/95 and will be terminated with the graduation of the last students. The first

students under the new educational system will graduate JKUCAT in August, 1994. The total number of students in 1994/95 will be 1,372.

The target year for the request made by the Kenyan side is 1994/95 and it is planned to materialize the contents of the request in the above three phases. Although the smooth recruitment and training of teaching staff described in (1) is a precondition for the successful implementation of the Project, this phased implementation of the Project appears realistic and appropriate in view of consolidation the basis of JKUCAT which is expected to become an independent university in 1995/96.

The Revised Master Plan of the Kenyan side anticipates the opening of the new Faculty of Science and Faculty of Social Science, as well as the introduction of new bachelor degree courses in Architecture, Mechanical Engineering and Electrical and Electronic Engineering, in 1995/96. It also plans to commence master degree courses in both the Faculty of Agriculture and Faculty of Engineering in 1999/2000 and to accordingly increase its admissions. It may be appropriate, however, to review these plans in the future before their implementation based on the actual progress of this Project up to 1994/95 which is the target year of completion.

The current teaching staff conditions are described below in view of the commencement of the new bachelor degree courses.

It has already been decided that the Faculty of agriculture and Faculty of Engineering will provide diploma courses under the new system which will be continued after JKUCAT has been upgraded to an independent university. The Faculty of Agriculture's provision of diploma courses vis-a-vis the technician courses of the Faculty of Engineering has contributed to the generally high level of diploma education at JKUCAT as it has enabled the college to recruit teachers with B.sc or higher degrees.

In the case of the Department of Horticulture which will commence its bachelor degree course prior to other departments, 6 of its total 13 teachers have a M.Sc degree, 2 of which obtained their degrees in Japan. The academic qualifications of the Department of Horticulture's teaching staff should, therefore, be sufficient to conduct a B.Sc degree course.

The Department of Food Technology will have 4 teachers with a M.Sc degree when those currently studying abroad return prior to the commencement of the

bachelor degree course and the possible new recruitment of M.Sc holders will further consolidate the Department's staff. The postharvest technology course which will be newly opened this time is one that had been planned mainly by this Department all along. As there is no similar course currently available in Kenya, the demand for graduates of such a course is said to be fairly high.

The Department of Agricultural Engineering has 10 teachers for the agricultural machinery course and 6 teachers for the agricultural civil engineering course, or a total of 16 teachers on the register. Of these, 6 are now under training, and when these teachers have returned from training, the Department will have one Ph.D holder, 5 M.Sc holders and 6 B.Sc holders. With this staff, and by supplementing whatever shortfall with new recruitment, it will be possible to offer bachelor's degree courses.

The Department of Building and Civil Engineering currently has a total of 23 teachers, 4 of which are studying in Japan. With the return of 2 M.Sc degree holders in April, 1988, the Department now has 3 teachers with a master's degree and 4 with a B.Sc degree, further consolidating teaching staff.

Eight well-qualified graduates of JKCATG have so far been recruited as technicians, 3 of which are currently studying at TUP and are scheduled to return to JKUCAT by the end of 1990 with their bachelor's degree. Another technician will be sent to TUP in April 1990, making steady progress in the consolidation and improvement of the teaching staff in preparation for the upgrading of JKUCAT to a university.

(3) Fostering of Manpower to Contribute to Socio-economic Development

Kenyan society requires people with strong technical skills for local development in various fields. The fostering of these people through higher education means the provision of specialized knowledge and technologies for local communities to solve immediate problems and to assist national policies, thereby contributing to the overall development of the country.

The Kenyan Ministry of Education stresses the importance of education to foster engineers in accordance with the objectives of the National Development Plan and suggests the promotion of technical education within the following framework.

Firstly, the main target in the agricultural sector is to increase productivity by the introduction of improved seeds and the development of small-scale

irrigation projects, etc. The combination of a scientific approach with agricultural technologies is stressed for the successful promotion of agriculture.

Secondly, in the industrial sector, the fostering of import-substitution industries and small but productive industries in promoting local economies is stressed. As agricultural development necessitates the provision of small centres to repair and maintain machinery in local areas, these centres should be located in local cities. Small agriculture-related industries should also be fostered in these cities.

As the graduates of JKUCAT will be expected to act as reformers in agricultural areas and managers in small import-substitution industries, the implementation of the Project to provide the manpower required in these fields is deemed highly necessary.

3.2.2 Examination of Implementation and Management Plans

(1) Personnel Plan

The supreme decision-making organization of JKUCAT is the University College Council and the University College Academic Board is subordinate to the Council. All departments and sections of JKUCAT are controlled by the Principal and Deputy Principal, i.e., Administration (Personnel Administration and Central Service, Recruitment and Training, Estate Management and Maintenance and Transport Services), Finance, Farm Management, Library, Faculty of Agriculture, Faculty of Engineering, Faculty of Science (as Service Faculty), Faculty of Social Science (as Service Faculty), Students (Catering and Games), Academics (Examinations, Admissions and Records and Staff Development and Planning), Information and Public Relations, College Health and Security. The number of staff in 1994/95 which is the target year of the Project will be 232 teaching staff, 262 nonteaching staff and 438 other management staff (77 officers and 361 non-officers), totalling 932.

As already described in 3-2-1, the expansion of the facilities will be conducted in three phases. The 139 management staff in 1988/89 will be increased to 438 in 1994/95. The personnel plan which anticipates the reassignment of the present staff, in addition to new staff recruitment, satisfies the required number of staff in each phase and, therefore, appears appropriate. The number of teaching staff

will be 232 in 1994/95 and will be subsequently increased in accordance with the expansion of JKUCAT as in the case of management staff. The anticipated number of teachers satisfies the Kenyan guidelines for universities which suggest that the number of teachers should be one-sixth of the number of students. Issues relating to teacher recruitment and their upgrading are discussed in section 3.2.1 (1) of this report.

(2) Budget Plan

The Ministry of Education is already securing the necessary budget for the construction work to be conducted by the Kenyan side for the expansion of JKUCAT. A budget amount of 80,184,000K.sh is to be secured for fiscal 1989/90 and details are given in section 4.4.6 Estimated Project Cost. Although the budgetary appropriation following facility expansion will depend on the progress of the sixth National Development Plan (1989 ~ 1994), it can be assumed that a sufficient budget will be appropriated in view of the Kenyan Government clearly stating its intention to continue its policy of emphasising education, particularly the expansion and improvement of higher education, in the sixth Plan. The budgetary appropriation for university education in the Ministry of Education's budget in recent years is as follows.

Ratio of University Education Budget in Ordinary Budget of the Ministry of Education

fiscal 1987/88	:	12.9%
fiscal 1988/89	:	14.8%

The above figures indicate the increasing emphasis placed on university education by the Ministry of Education.

3.2.3 Examination of Requested Facilities and Equipment

(1) Facilities

The facilities requested by the Kenyan side are determined based on a target year of 1994/95, when the number of JKUCAT's staff and students will be almost double that of September 1988, and the requested facility sizes are based on an expected total number of 1,372 students and 232 teachers. The requested facilities consist of such educational facilities as common lecture rooms, laboratories, workshops and a library, etc., a water purification plant,

administration facilities including an administration building and such welfare facilities as student accommodations and a dining hall, all of which correspond to JKUCAT's planned educational activities. In regard to student accommodations, although their necessity cannot be denied vis-a-vis the current boarding system, it is believed appropriate that these accommodations be constructed through the Kenyan side's own efforts.

The following principles should be adopted in deciding the facility sizes to achieve economy and the efficient use of the existing facilities.

- 1) Despite the original request for separate lecture rooms for each faculty, these should be integrated in a single common lecture building in view of economy with excepted one separate lecture room each for the Faculty of Agriculture and Faculty of Engineering.
- 2) In planning the layout of facilities, some of the existing facilities will be reassigned to other uses in order to bring the rooms related to the existing laboratories of each Department as close to each other as possible.
- 3) While the expansion of those facilities which are already overcrowded (i.e., staff offices) should be considered as part of the Project, facilities for common use should be planned to meet the minimum requirements.
- 4) The existing library should be converted to office space for teachers of common subjects and for use as a resource centre, for provision of teaching Materials.

(2) Equipment

The equipment requested by the Kenyan side is largely classified into the following categories.

- Teaching Equipment for Exclusive Use for New Courses
 - Bachelor Courses, Faculty of Agriculture; Teaching equipment for Department of Horticulture, Department of Agricultural Engineering, and Department of Food Technology (including Postharvest Technology Courses)
 - Bachelor Course, Faculty of Engineering; Teaching equipment for Civil Engineering Course of Department of Building and Civil Engineering

- HND Courses, Faculty of Engineering; Teaching equipment for Architecture Course Department of Building and Civil Engineering, Department of Mechanical Engineering and Department of Electrical and Electronics Engineering
- Teaching Equipment for Mathematics and Science Subjects (Common for both Faculties of Agriculture and Engineering)
 - Equipment for science subjects (Chemistry, Biology, Physics and Mathematics)
 - Equipment for computer Practice
- Others
 - Library equipment

Each equipment in the equipment list presented by the Kenyan side carries a priority ranking. It appears that the list of the requested equipment was prepared on the basis of the plan of curricula and syllabuses (draft). Although, these plan have not yet been finalized, examination of the necessity and appropriateness of the requested equipment is based on the following:

- 1) The minimum equipment which must be necessary for the implementation and are provided as fixtures and fittings for the buildings (furniture, laboratory tables and draft chambers, etc.,) will be included in the Project.
- 2) Large equipment deemed highly necessary in view of the curricula and syllabuses for basic subjects (compulsory subjects) will be given priority. With regard to other general equipment, the efficient utilization of the existing equipment is planned. New or supplementary equipment will be provided through technical assistance or other means in the case of a future equipment shortage due to the advancement of educational activities with the introduction of new courses.
- 3) That equipment currently in use for the existing OD and technician courses which is in an advanced state of deterioration or in shortage will be renewed or supplemented to satisfy the requirements of the new bachelor degree-and HND courses.

3.2.4 Necessary Technical Cooperation

Opened in May 1981, JKUCAT (originally started as JKCAT) has so far achieved positive results under the project-type technical cooperation of the Government of Japan which commenced in April, 1980.

While the achievement of some of the original objectives was initially delayed due to a shortage of teaching staff and other reasons, smooth management has now been firmly established through the strenuous efforts of the staff and Japanese experts who have performed their expected function of fostering engineers equipped with technical skills to contribute to the socioeconomic development of Kenya. The technical cooperation period has now been extended to April 1990 to further consolidate the fruits of the cooperation.

The Government of Kenya has requested not only grant aid assistance for the Project but also a further continuation of the project-type technical cooperation, mainly to further consolidate JKUCAT in view of its future upgrading to university status following the present Project's completion. In response to this request, the joint preliminary study was conducted in August 1988 with the Preliminary Study Team for grant aid assistance to confirm the necessity of and the requested contents of the technical cooperation.

The possibility of establishing an outstanding university in Africa through consistent technical cooperation is of great significance for Japan's ODA as a new type of economic and technical assistance and, therefore, it should prove of benefit for Japan to provide as much assistance as possible.

While facility construction and equipment provision by grant aid assistance are essential for the implementation of the Project, the project objectives cannot be achieved without the smooth operation of JKUCAT. The provision of project-type technical cooperation together with the grant aid assistance is believed appropriate in this context and should prove of benefit in assisting the proper and efficient use of the facilities and equipment to be provided by the grant aid assistance.

The main contents of the technical cooperation requested by the Kenyan side are as follows:

- 1) Provision of guidance and training for Kenyan counterparts

- 2) Consolidation of curricula and syllabuses and cooperation for teaching material preparation
- 3) Provision of advice on educational, research and academic activities
- 4) Provision of teaching and research equipment

3.2.5 Provision of Assistance

The implementation of the Project with the grant aid assistance of the Government of Japan is judged appropriate as the effects and feasibility of the Project and the implementation capability of the Kenyan side have been confirmed. This judgement is also supported by the fact that the Project will not only assist the Government of Kenya in pushing forward its policy of expanding higher education but will also play a significant role in the socio-economic development of Kenya by fostering a large number of well qualified engineers required for the Kenyanization of the economy and industries. Furthermore, the facilities to be constructed under the Project will prove extremely useful to achieve the maximum effect of technology transfer through Japan's project-type technical cooperation which is planned to commence in April, 1990. As a result, the project outline is examined next in view of preparing the Basic Design based on the assumed provision of grant aid assistance for the Project by the Government of Japan. As described earlier, however, it is believed appropriate to change some of the contents of the original Kenyan request in the Basic Design.

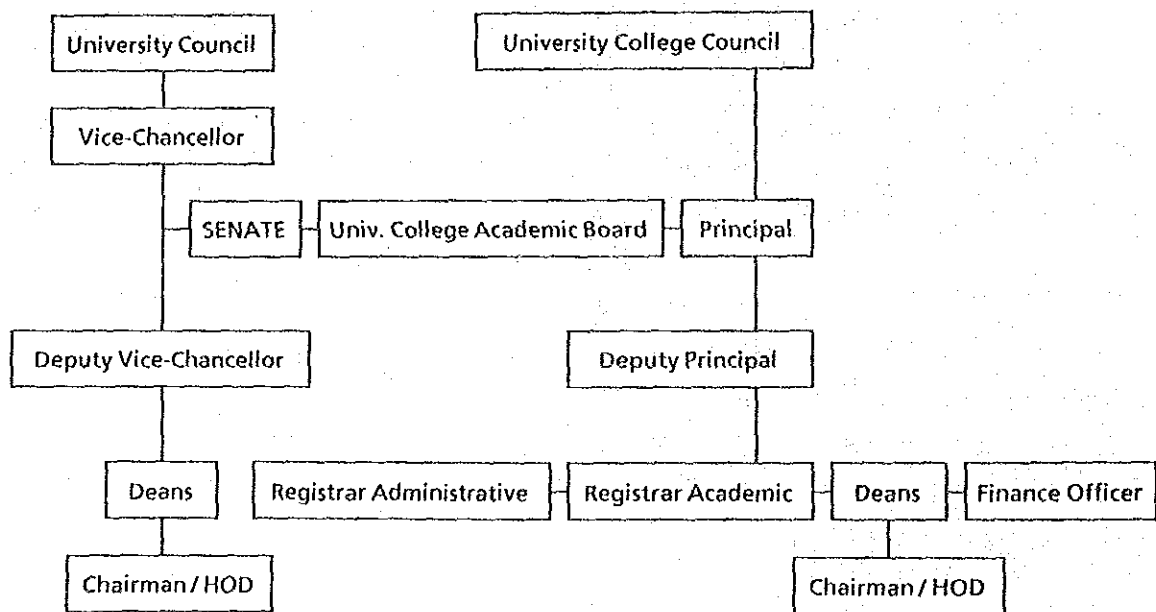
3.3 Project Outline

3.3.1 Implementation Agency and Operation System

Taking the opportunity of the upgrading of JKUCAT to a constituent college of Kenyatta University, the ministry responsible for the college was changed in September 1988 from the Ministry of Technical Training and Application Technologies to the Ministry of Education which is responsible for university education. Consequently, the Ministry of Education will be the responsible organization for project implementation and will be in charge of budgetary appropriation for the Project, the subsequent JKUCAT budget and coordination with other ministries (see organization of the Ministry of Education).

JKUCAT will operate as a constituent college of Kenyatta University pursuant to the University Act (see chart showing the relationship between JKUCAT and Kenyatta University).

■ Relationship between University and University College



The University College Council will be established as the supreme decision-making organization of JKUCAT and will decide basic policies relating to JKUCAT's operation and control. Based on these policies, the University College Academic Board, which is the equivalent of a faculty meeting in Japan, will decide concrete operation and activity programmes and will consist of the following members.

- Principal
- Deputy Principal
- Deans of Faculties
- Heads of Departments
- Librarian
- Dean of Students
- Registrars
- Technical Cooperation Team Members
(Leader and Assistant Leader)

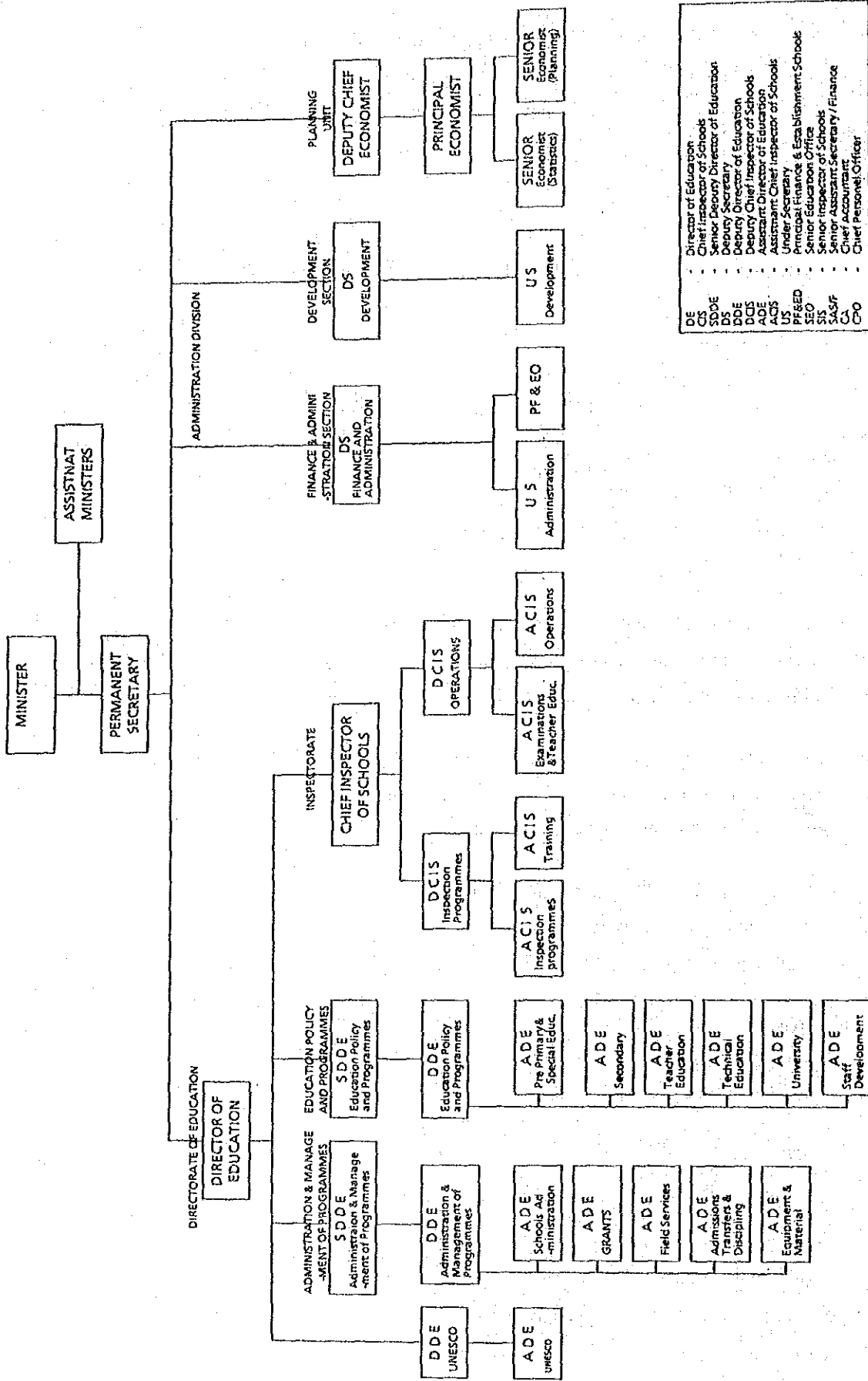
Of those items to be decided by the UC Academic Board, the Senate of Kenyatta University must be consulted in regard to the curricula, admission qualifications, rules for degree examinations and awarding of degrees.

The organization of JKUCAT will consist of the following sections and faculties, etc., under the Principal and Deputy Principal in addition to the UC Council and UC Academic Board (see organizational chart of JKUCAT).

- Administration (Personnel Administration and Central Services,
Recruitment and Training, Estate Management and
Maintenance and Transport Services)

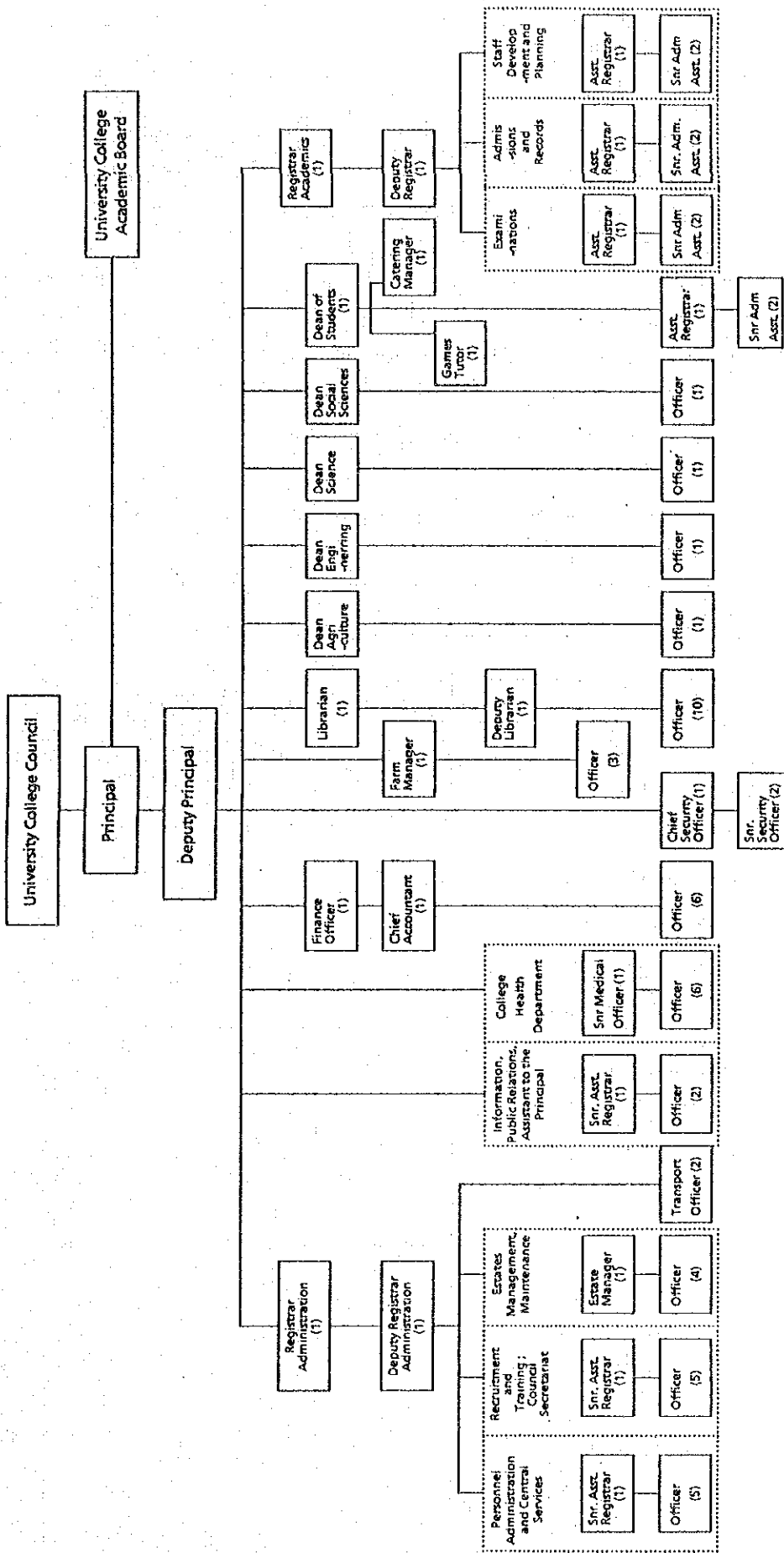
- Finance
- Farm Management
- Faculty of Agriculture
- Faculty of Engineering
- Faculty of Science*
- Faculty of Social Sciences*
- Students
- Academics (Examinations, Admissions and Records,
Staff Development and Planning)
- Information and Public Relations

Ministry of Education
Headquarters Organization Chart



- DE - Director of Education
- CS - Chief Inspector of Schools
- SDOE - Senior Deputy Director of Education
- DS - Deputy Secretary
- DDE - Deputy Director of Education
- DCIS - Deputy Chief Inspector of Schools
- ADE - Assistant Chief Inspector of Schools
- AGS - Assistant Chief Inspector of Schools
- US - Under Secretary
- PF&ED - Principal Finance & Establishment Officer
- SEO - Senior Education Officer
- SIS - Senior Inspector of Schools
- SAS/AF - Senior Assistant Secretary / Finance
- CA - Chief Accountant
- CPO - Chief Personnel Officer

Organizational Chart of JKUCAT



College Health
Security

(Note) * These will be organizationally treated as Faculties and student admission will officially commence in 1995/96.

The operating staff in 1994/95, which is the target year of completion of this Project, will consist of 232 teaching staff, 262 non-teaching staff and 438 other administrative staff (77 in the officer's level and above, and 361 in the staff level), totalling 932.

■ NUMBER OF STAFF AT 1994/95 (Excluding Teaching & Non Teaching Staff)

(Person)

Dept/Section	Officer	Staff	Sub Total
Principal	1	1	2
Deputy Principal	1	1	2
Administration Dept.			
Registrar / Deputy Registrar	2	2	4
Personal Admi. & Central Services Sec.	6	19	25
Recruitment & Training Sec.	6	9	15
Estate Manage. & Maintenance Sec.	5	70	75
Transport Service Sec.	2	8	10
Information & Public Relations Sec.	3	5	8
Health Sec.	7	18	25
Finance Dept.	8	8	16
Security	3	25	28
Farm Management	4	90	94
Library	12	60	72
Student Dept.	6	25	31
Academics Dept.			
Registrar / Deputy Registrar	2	2	4
Examinations Sec.	3	6	9
Admissions & Records Sec.	3	7	10
Staff Develop & Planning Sec.	3	5	8
Grand Total	77	361	438

3.3.2 Planned Courses

(1) Departments and Courses

The following departments and courses will be introduced with the implementation of the Project (also see Table: Department/Course and Number of Students). Of the existing courses, technician courses of the Faculty of Engineering will stop accepting new admissions in 1989/90 and will be switched to the OD courses thereafter. OD courses of the Faculty of Agriculture will stop accepting new admissions in 1994/95 and the courses will be completely withdrawn with the graduation of the last students..

New Courses

○ Bachelor Courses (4 years)

Faculty of Agriculture:

- Department of Horticulture 40 students/year
- Department of Agricultural Engineering 40 students/year
 - Agricultural Civil Engineering Course
 - Agricultural Mechanical Engineering Course
- Department of Food Technology 20 students/year
- Postharvest Technology Course 20 students/year

Faculty of Engineering

- Department of Building and Civil Engineering
 - Civil Engineering Course 40 students/year

(Total : 640 students)

○ HND Courses (2 years)

Faculty of Engineering:

- Department of Building and Civil Engineering
 - Architecture Course 40 students/year

- Department of Electrical and Electronics Engineering 40 students/year

- Electrical Engineering Course
- Electronics Engineering Course

- Department of Mechanical Engineering 40 students/year

- Automobile and Prime Movers Engineering Course
- Production Engineering Course

(Total : 240 students)

OD Courses (up to 1994/95) (Total : 492 students)

(2) Curricula and Syllabuses

The curricula and syllabuses for the new courses are still in the drafting stage and the final decision on them will be made by University College Council and the Senate of Kenyatta University. The currently planned curricula and syllabuses for all the new courses are divided into common subjects and specialized subjects, the number of lecture/practice periods and the contents of which are given in the Appendix.

1) Common Subjects

The newly introduced bachelor and HND courses will require students to study several common subjects depending on the course level and course aims. These common subjects are divided into natural science subjects, the study level of which depends on the course aims, and liberal arts and social science subjects. (Refer to Appendix)

- Mathematics and Science Subjects

Mathematics

Computer Practice

Physics

Chemistry

Biology

- Social Science Subjects

English

Sociology

Anthropology

Environmental Science

Economics

Politics

2) Specialized Subjects

The study of specialized subjects consists of relevant lectures and practice/laboratory work at JKUCAT or outside. The specialized subjects for each course include core subjects to provide students with basic knowledge as well as special subjects and are briefly described below.

○ Bachelor Courses

<Faculty of Agriculture>

- Department of Horticulture

Core Subjects

introduction to general agriculture, horticulture and animal husbandry, agricultural production in the tropics and history of world agriculture, etc.

Basic Cultivation

basic subjects relating to cultivation, plant growth and seed production of various types of crops and plants including plant morphology and anatomy; applied subjects including physiology, entomology, pathology, genetics, plant breeding and soil science, etc.

Cultivation Technology

applied subjects relating to grain production, fruits, vegetables, and flowers, etc.

Farm Management

mostly a theoretical approach to agricultural policies, rural sociology, agricultural marketing and agricultural cooperatives, etc.

• Department of Agricultural Engineering

Agricultural Civil Engineering Course

Core Subjects

introduction to agriculture, animal production and agricultural engineering, etc.; basic practice of surveying, drawing and computer programming, etc.

Structural Engineering

basic civil engineering subjects such as oil mechanics and structural mechanics; applied subjects such as agricultural structures and design

Agricultural Foundation Engineering

applied subjects such as soil physics, soil and water conservation and farm management in relation to farmland planning, preparation and improvement, etc.

Irrigation and Drainage Engineering

basic and applied subjects including hydraulics, hydrology and rural water resources development with emphasis on irrigation and drainage; resources development; watershed management

Agricultural Mechanical Engineering Course

Core Subjects

same as for Agricultural Civil Engineering Course

Basic Mechanical Engineering

thermodynamics, electrical engineering and material mechanics

Agricultural Machinery Engineering

subjects relating to farm machinery and mechanization of agriculture; processing of agricultural products by indoor machinery; farm machinery design, etc.

• Department of Food Technology

Core Subjects

natural science subjects such as physics, biology, chemistry and dynamics; basic specialized subjects such as food technology and food science

Food Chemistry

human nutrition mainly dealing with food analysis, food chemistry and food toxicology, etc.

Food Microbiology

food microbiology to study metabolism, physiology and mutation of microbes useful for food processing; applied subjects including fermentation technology

Food Technology

basic subjects relating to food processing and production

Food Processing

applied subjects including food preservation and processing

● Postharvest Technology Course

Core Subjects -- same as for Food Technology Course

Food Chemistry -- same as for Food Technology Course

Food Microbiology -- same as for Food Technology Course

Food Technology

basic subjects relating to food processing

Basic Postharvest Technology

basic subjects relating to primary treatment/processing technologies for harvested crops

Postharvest Technology

applied research on postharvest technologies; application of postharvest technologies to grains and vegetables, etc.

<Faculty of Engineering>

● Department of Building and Civil Engineering

Civil Engineering Course

Core Subjects

fluid mechanics, hydraulics, soil mechanics and other mechanics; public health engineering and geology, etc.

Structural Materials and Design

basic and applied subjects such as concrete technology, reinforced concrete, construction materials and irrigation engineering, etc.; various designs

Construction Engineering

applied subjects relating to civil engineering work

Housing Planning

basic and applied subjects relating to building services and urban planning, etc.

Others

concrete specifications, surveying and architectural drawing, etc.

○ HND Courses

< Faculty of Engineering >

● Department of Building and Civil Engineering

Architecture Course

Core Subjects

basic subjects such as basic dynamics and engineering, history of architecture and architectural laws and regulations, etc.,

Building Planning and Designing

applied subjects such as architectural planning, urban planning, physical environment and architectural equipment

Structural Engineering and Materials

basic and applied subjects relating to structural dynamics and structural materials

Others

material experiments and design/drawing, etc.,

- Department of Electrical and Electronics Engineering

- Electrical Engineering Course

- Core Subjects

- basic subjects such as electrical and electronic engineering and instrumentation engineering, etc.

- Basic Electrical Engineering

- subjects relating to electrical appliances, control equipment and electrical systems

- Basic Electronic Engineering

- basic subjects relating to electronic engineering

- Electrical Engineering

- power electronics, power systems, instrumentation and measurements, etc.

- Electronics Engineering Course

- Core Subjects -- same as for Electrical Engineering Course

- Basic Electrical Engineering -- same as for Electrical Engineering Course

- Basic Electronics Engineering -- same as for Electrical Engineering Course

- Electronics and Communication Systems

- subjects relating to microdigital electronics, industrial electronics and communication systems

- Department of Mechanical Engineering

- Automobile and Prime Movers Course

- Core Subjects

- basic mechanics and materials, etc.

- Automobile Engineering

- mechanism and manufacture of automobiles and prime movers

- Others

- machine design and factory practice, etc.

- Production Engineering Course

Core Subjects

basic mechanics and subjects relating to production environment and production control

Production Engineering

production engineering, planning and control

Others

factory practices

3.3.3 Location and Conditions of Project Site

(1) Location of Project Site

The subject site of the Project is JKUCAT campus which is located some 40km northeast of Nairobi in Juja Village of Thika Division, which is in Kyambu District of Central Province. It takes some 30 minutes to reach the project site from Nairobi by dual carriageway (Thika Road) and the main transportation between Nairobi and the project site is by bus (approximately 20 services/day between Nairobi and Juja by public and private bus companies), although railways lines for cargo trains run near the site.

The area around the project site has many sisal, coffee, tea and pineapple estates and a town with a population of some 5,000 (Juja) has been spontaneously established, mainly by the estate workers. Thika, a busy city with a population of some 50,000, is located 10km northeast of Juja and acts as the local administrative centre. An industrial park was recently constructed near Thika and food processing, metal processing, tobacco and textile plants are currently in operation.

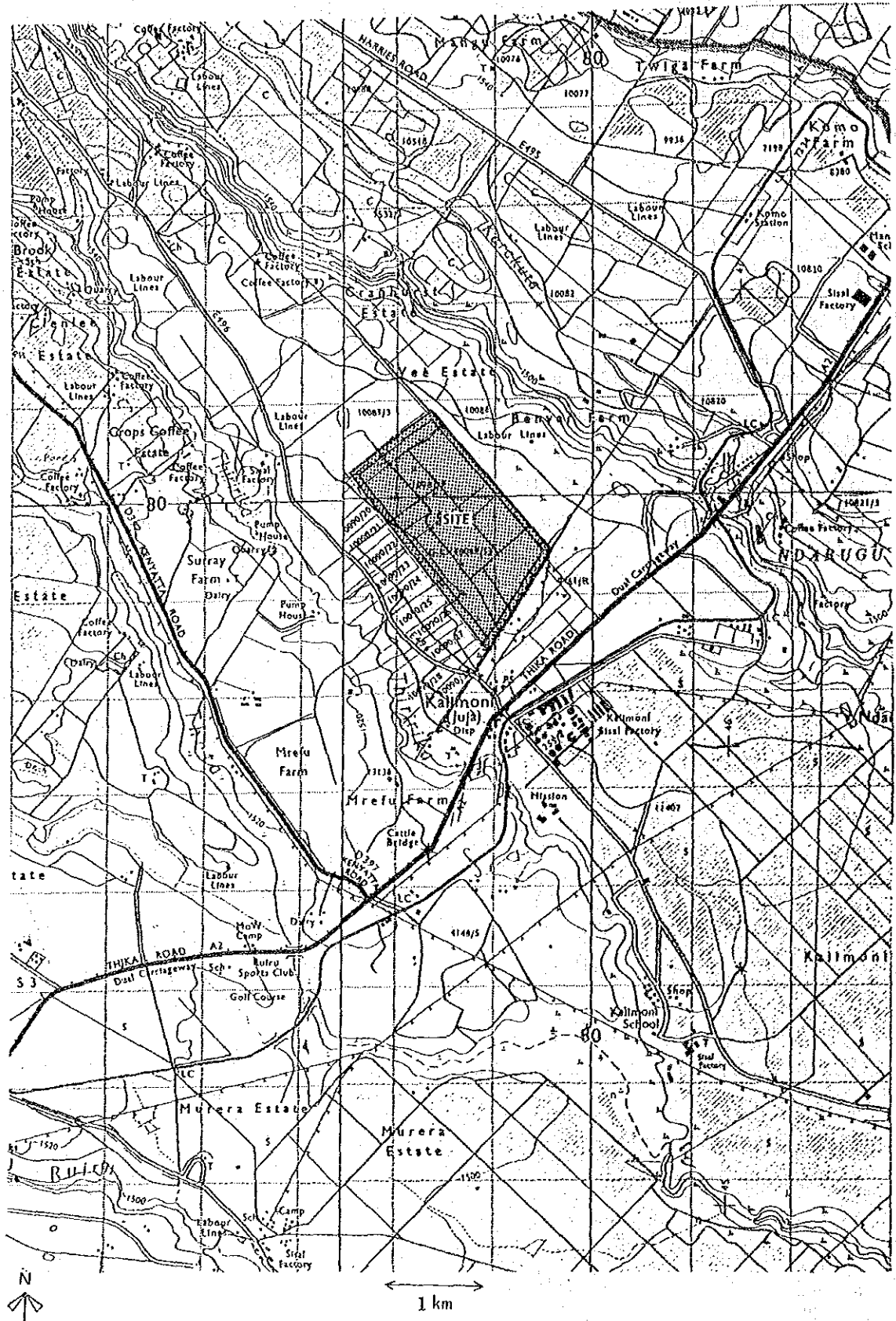
(2) Conditions of Project Site

The project site has a rectangular shape of 1,900m × 1,000m (approximately 200ha with its main axis running in the NE-SW direction and gently inclining from north to south.

There is a weathered tuff layer 1 to 2m below the surface which is covered by clayey soil. The Ndargu River flows 1km northeast of the project site and is used for irrigation water intake for JKUCAT's farm. The main facilities currently on the project site are as follows (see Site Plan for locations):

- Administration Building
- Assembly Hall
- Library
- Common Lecture Building
- Welfare Facilities
- Student Dormitories
- Agricultural Laboratory Building
- Agricultural Workshop Building
- Engineering Laboratory Building
- Engineering Workshop Building

Construction Site



- Greenhouse
- Farm Building
- Staff Houses
- Experimental Farm (Farm Pond, Irrigation Facilities and Farm) and
- Auxiliary Facilities

(3) Natural Conditions of Project Site

1) Temperature/Humidity/Rainfall

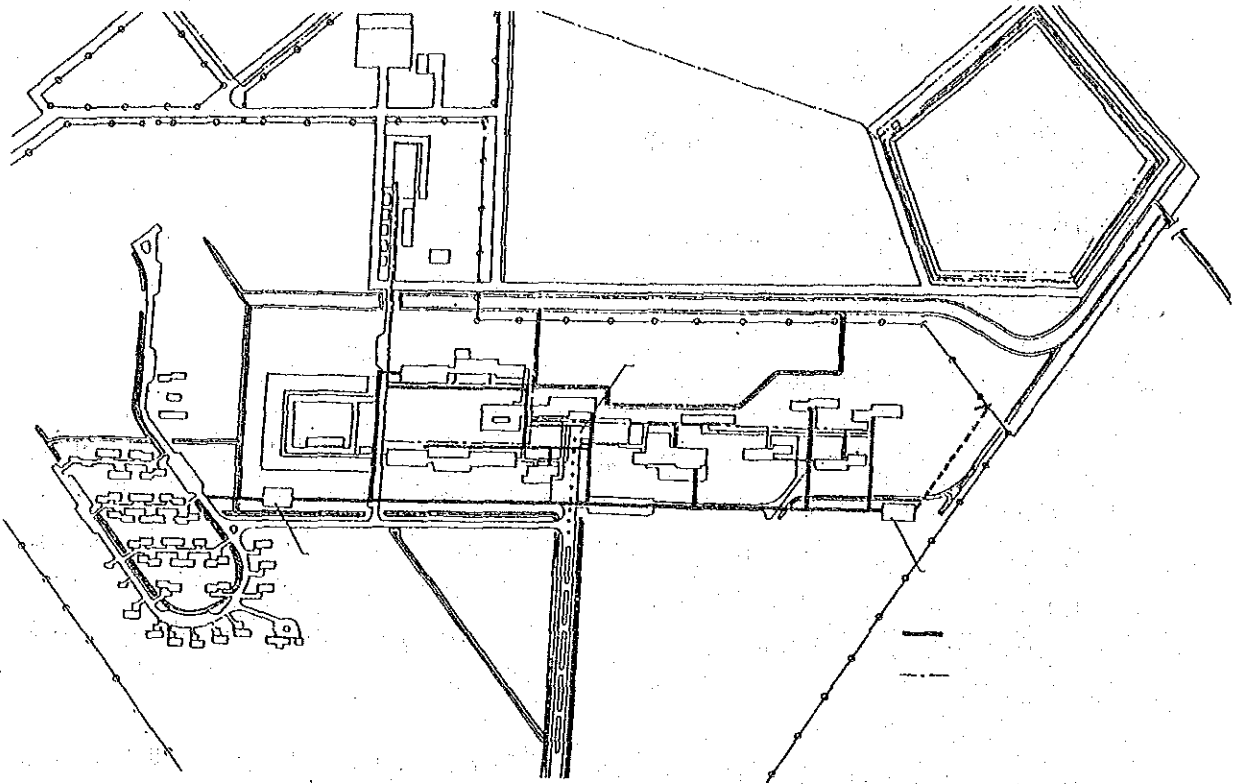
Despite its proximity to the equator, the average monthly temperature in Kyambu District of 17 to 22°C is almost constant throughout the year due to the area's high elevation of some 1,500m. The average maximum and minimum temperatures are 28.1°C and 10.9°C respectively and, with almost constant humidity of 50 to 70%, the area enjoys a comfortable climate.

There are two rainy seasons: the long rainy season between March and May and the short rainy season between October and December. There is relatively little rainfall between June and September while April has the highest average monthly rainfall of 488mm. The annual rainfall is generally 900 to 1,000mm although rainfall of 1,500 to 1,600mm has sometimes been recorded in the past.

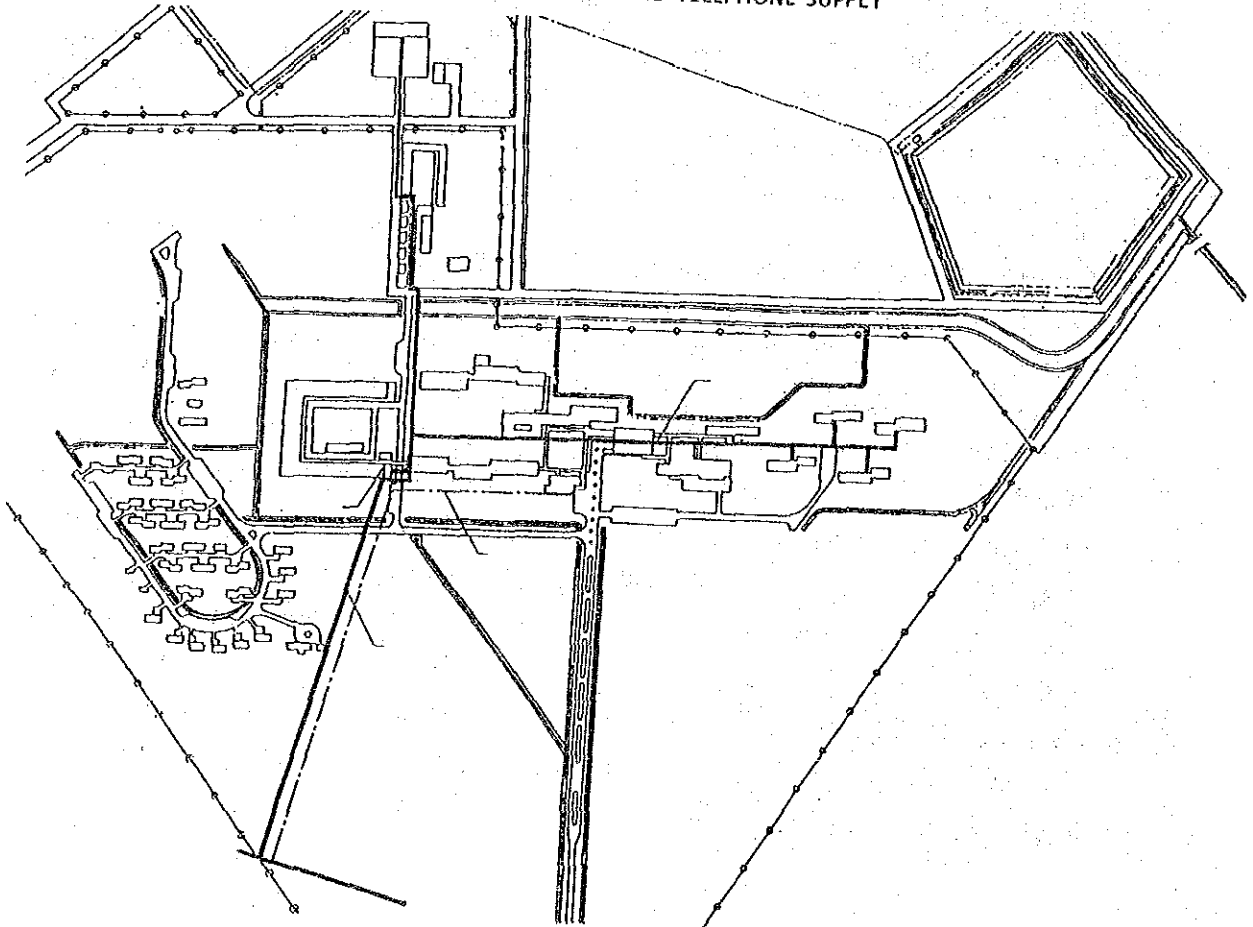
2) Constant Wind/Wind Direction/Wind Velocity

Kenya's climate is determined by atmospheric pressure differences between the Indian Ocean and the African Continent. The wind direction reflects these differences and the prevailing wind between December and March is from the northeast while an east wind prevails between March and May and a southeast wind prevails between June and August. Between September and December, the prevailing wind gradually changes from the southeast to the northeast. The wind direction at the project site is assumed to follow this general pattern. There are no strong winds and no special consideration in the structural planning is required in this regard. However, the wind direction should be taken into consideration to facilitate the natural ventilation of the buildings.

EXISTING WATER SUPPLY AND DRAINING SYSTEM



EXISTING ELECTRIC POWER AND TELEPHONE SUPPLY



(4) Conditions of Infrastructure

1) Water Supply

Although 5 wells have been dug on the project site to supply water for the campus using pipes of 100 ϕ in diameter and 150m in length, 3 of these wells have in fact dried up or fluorides have been detected in them, and the remaining 2 wells cannot provide a constant water supply as they are located in the tuff layer with a low permeability coefficient which slows down water accumulation in the aquifer below following water intake. While water is supplied to the campus from the nearby estates to cover the shortage, the water volume required by the campus is not sufficiently met.

The Third Water Supply Improvement Plan (1989 – 2010) has been prepared to expand public water supply facilities. However, the plan does not involve the supply of water to the campus as Nairobi is given water supply priority to meet the population increase.

2) Drainage

The gravity drainage method is employed to drain domestic wastewater (sewage and miscellaneous wastewater) from the existing buildings to the wastewater tank and the wastewater is then pumped to the water treatment facility located 1km east of the campus. Laboratory wastewater is neutralized at the neutralization tank prior to discharge to the wastewater tank while rainwater from the building roofs and roads, etc., is drained to open ditches around the campus. The capacity of the existing water treatment facility is believed to be large enough to deal with the wastewater volume of the expanded JKUCAT.

3) Power Supply

High voltage power (11KV, 50Hz) is already supplied to the existing transformer facility. The existing power room is actually partitioned into 2 blocks, i.e., the substation owned by the Kenya Power and Lighting Co., Ltd. (KPL) and the power distribution room owned by JKUCAT. The substation houses the circuit breaker for initial power supply and a 1,000KVA transformer of KPL. The study on the power consumption of the existing facilities showed that the maximum and minimum monthly consumption volumes in the 12 months previous to the study were 220KVA and 175KAVA respectively. The existing transformer capacity is large

enough to meet the consumption increase following the Project's completion.

4) Telephone Lines

Telephone lines to the campus are initially connected to the main distribution frame (MDF) in the existing administration building and the following lines are currently available.

- operator lines	...	4
- direct lines	...	4
- public telephone lines	...	2
(Total: 10)		

An additional 15 lines will also be required to serve the new facilities to be constructed under the Project by 1994/95. Consultations with the Kenya Posts and Telecommunications Corporation (KPTC) confirmed that these additional lines will be provided by KPTC.

3.3.4 Outline of Facilities and Equipment

(1) Facilities

The total floor area of the new facilities was determined based on the calculation of the floor area required for each room/facility, which was in turn decided in accordance with the requirements of the personnel plan and the planned courses. Consultations with the Kenyan side found that a total floor area of some 14,072m² will be sufficient instead of the requested 16,330m² excluding the floor area of student hostels. The required rooms and their floor areas for each faculty or facility are listed below.

I-1 Faculty of Agriculture

Department	Original Request	Examination Result	Remarks
Horticulture	Laboratories 2	Plant Nutrition Laboratory 1 Environmental Control Laboratory 1	
	Others 2	Soil Sterilization Room 1	
Agricultural Engineering	Laboratory 1	Irrigation & Drainage Laboratory 1	
	Workshops 2	Agricultural Machinery Workshop (including Machinery Hardstanding) 1	
	Others	Surveying Preparation Room 1	
Food Technology	Laboratories 2	Food Biochemistry Laboratory 1 Micro-Biology Laboratory 1	
	Workshop 1	Postharvest Laboratory 1	
	Others 2	Storage 1	
	Common use of the Faculty	Lecture Rooms 5 Lecturers' Rooms 42	Lecture Room (40 Students) 1 Drawing Room (20 Students) 1 Lecturers' Roms 49

I-2 Faculty of Engineering

Department	Original Request	Examination Result	Remarks		
Building and Civil Engineering &	Laboratories 2	Construction Material Testing Laboratory 1			
	Workshops 6	Physical Environmental Laboratory 1			
		Drawing Rooms (20 Students each for Architecture & Civil Engineering) 2			
		Architectural Model Work Room 1 Model Room 1			
Others 1	Reference & Printing Room (Common Use by Faculty of Engineering) 1				
Mechanical Engineering	Laboratories 3	Metrology Laboratory 1 Thermodynamics Laboratory 1 Fluid Engineering Laboratory 1			
	Others 1	Machinery Hard Standing 1			
	Electrical & Electronics Engineering	Laboratories 2	Digital Electronics Laboratory 1 Control Laboratory 1		
		Others 1	Illumination Laboratory 1 Electrical Measurement Laboratory 1 Communication Laboratory 1		
Common use for the Faculty			Lecture Rooms 5 Lecturers' Rooms 28	Lecture Room (40 Students) 1 Drawing Room (20 Students) 1 Lecturers' Rooms 38	

I-3 New Common Lecture Building

Department	Original Request	Examination Result	Remarks
Common Subjects	Laboratories 3	Physics Laboratories (40 Students) 2 Chemistry Laboratory (40 Students) 1 Biology Laboratory (40 Students) 1	conversion of old Library
	Lecturers' Rooms (13 Rooms will be Provided by Old Library Space of 100m ²) 6	Lecturers' Rooms 37	
Common for Both Faculties of Agriculture & Engineering	Lecture Rooms (100 Students) 4	Lecture Theatre (100 Students) 1	conversion of old Library
	Lecture Rooms (60 Students) 2	Lecture Rooms (60 Students) 6	
	Lecture Rooms (40 Students) 3	Lecture Rooms (40 Students) 9	
	Computer Room 1	Computer Practice Room (including Staff room and Seminar room) 1	

I-4 Water Purification Plant

Department	Original Request	Examination Result	Remarks
	Water Purification Plant	Building (1) + Water Purification Unit + Water Tank	

I-5 Library

Department	Original Request	Examination Result	Remarks
Library	Reading Space with 600 Seats & an Office	Reading Room (411 seats) including Book Stack Space Seminar Room 1 Reference Desk, Periodical Space Locker Room 1 Reception Counter 1 Office 1 Work Room 1 Binding Room 1 Sorting Room 1 Librarian's Room 1 Secretary's Room 1 (also serving as Waiting Room for Librarian's Room) Deputy Librarian's Room 1	near the entrance Lobby

I-6 Resource Centre

Department	Original Request	Examination Result	Remarks
Resource Centre	Printing Room, Audio-Visual Room, Office	Printing & Binding Room (Teaching Materials) Office Audio-Visual Room (including Staff Room)	existing Teaching Materials Preparation Room extended to be located in the Library Room

II Administration

Department	Original Request	Examination Result	Remarks
Administration Building	Principal's Room	1	use of existing bldg.
	Deputy Principal's Room	1	
	Project Leader's Room	1	
	Offices		
	Conference Rooms		
	Provisional Lecturers' Room	1	
	UC Council Chairman's Room	1	
	Principal's Room	1	
	Deputy Principal's Room	1	
	Project Team Leader's Room	1	
Project Office	1	use of existing bldg.	
Offices			
- Administration (Personnel Administration, Recruitment & Training, Estates Management)			
- Information & Public Relations			
- Academics (Examinations, Admissions/Records, Staff Development/Planning)			
- Accounting Office			
Conference Room (40 Seats)	1		
PABX Room (Telephone Exchange)	1		
Reception Rooms	2		
Maintenance Workshop, Office & Storage		Maintenance Workshop Office for Above	1 1

III Welfare Facilities

Department	Original Request	Examination Result	Remarks
Student Hostels	Student Hostels (700 Students) Conversion of Old Library & its Office to Student Centre (1,400 Students)	Student Hostels (652 Students) (Total Accommodation Capacity : 1,372 Existing Capacity : 720)	The construction of Student Centre and student hostels will be reviewed & conducted by Kenyan side
Canteen	Canteen Kitchen	Canteen Kitchen	

The requested and planned floor areas of the buildings are listed in the following table for comparison purposes.

Name	Existing (m ²)	Expansion Project		Remarks
		Requested Floor Area (m ²)	Planned Floor Area (m ²)	
Administration Building	979	1,770	1,474*	*including maintenance work shop (120m ²)
Assembly Hall	1,178			
Library Building	3,256	2,100	2,132	audio-visual room
Common Lecture Building			105	
Welfare Facilities Building	1,916	2,840	2,199	additional canteen to be constructed by Kenyan side
Student Hostels	7,920	490	450	
Faculty of Agriculture				
- Laboratory Building	1,804	3,340	3,354	
- Workshop Building	1,259			
- Machinery Hard Standing	432			
- Farm Buildings	1,920			
- Cattle Shed	216			
Faculty of Engineering				
- Laboratory Building	2,756	4,350	3,842	
- Workshop Building	4,039			
- Painting Workshop Building	324			
Resource Centre		640	-	audio-visual room (105m ²) in Library Building
Staff Housing	5,320			
Greenhouse and Lath Houses	449			
Power Substation Building	104			
Water Purification Plant		800	516	
Total	33,872	16,330*	14,072	* excluding floor area of 6,000m² for student hostels

The planned conversion of the existing buildings is as follows.

Name	Current Use	Planned Conversion		Remarks
	Room Name (m ²)	New Room Name (m ²)	Subject Floor Area to Improvement Work (m ²)	
Existing Agricultural Laboratory Building	Agricultural Engineering Laboratory (149)	Post harvest Laboratory - 1	0	to be used as they are now
	Soil Mechanics Laboratory (95)	Post harvest - 2 Laboratory	0	as above
	Soil Physics Laboratory (108)	Microbiology Laboratory	0	as above
	Soil Mechanics Preparation Room (13)	Storage	0	as above
Existing Engineering Laboratory Building	Material Science Laboratory (95)	Electrical Measurement Laboratory	0	as above
	Mechanical Science & Elementary Fluid Laboratory (176)	Communication Laboratory, Stg. & Printing Room	0	as above
Existing Administration Building	Conference Room (72)	Office (72)	72	
	Staff Lounge (54)	Staff Lounge-cum-Conference Room (54)	54	
Existing Common Lecture Building	Drawing Room (461)	Lecture Rooms (461)	0	to be used as it is now
	Reading Room (558)	Lecturers' Rooms(594)	594	
	Entrance Hall (36)			
	Office, Storage (72)	Reosurce Center (72)	72	
	Work Room (54)	Office (54)	54	
Total			846	

(2) Equipment

The equipment to be provided under the Project are assorted for the department / courses and related facilities as follows:

● Faculty of Agriculture

A Equipment for Department of Horticulture – the equipment required for basic research and observation relating to plant tissues, physiology, morphology and ecology, etc., and for applied research on cultivation technologies and seed production technologies, etc.

B Equipment for Department of Agricultural Engineering

Agricultural Civil Engineering Course – the equipment required for farm improvement, irrigation, drainage and water utilization experiments, etc.

Agricultural Mechanical Engineering Course – the equipment required for practical training, including trial manufacture, repair and maintenance of agricultural machinery, and for training, etc.

C Equipment for Department of Food Engineering

Food Technology Course – the equipment required for such basic research as food analysis and nutrition analysis and for research and practical training on food processing technologies

Postharvest Technology Course – the equipment required for research, practical training and experiments on processing and preservation of agricultural and animal husbandry products

● Faculty of Engineering

D Equipment for Department of Civil Engineering and Architecture – the equipment required for analysis, experiments and practical training on civil materials and structures and for design and drawing practice

E Equipment for Department of Electrical and Electronic Engineering – the equipment, instruments and teaching materials, etc. required for

basic and applied experiments for both electrical engineering and electronic engineering courses

F Equipment for Department of Mechanical Engineering – the equipment required for machining practice and for experiments

● Mathematics & Science Subjects

G Equipment for Chemistry and Biology – the equipment required for chemical, experiments, analysis and measurements and for biological analysis, observations and experiments.

H Equipment for Physics and Mathematics – the equipment required for experiments and measurements for physics and mathematics as basic subjects

I Equipment for Computer Training – the equipment required for computer education which is common for all courses

● Others

J Equipment for Library – the equipment required for book records and lending records, etc., and library furniture and fixtures

3.3.5 Management and Maintenance Plans

(1) Management Plan

Following the completion of the new facilities and their handing over to the Government of Kenya, the JKUCAT will be responsible for the management and maintenance of the new facilities and equipment. In regard to the operational budget, the Ministry of Education which is in charge of university education will be responsible for securing the necessary budget for the JKUCAT's operation.

While the Estate Management and Maintenance Section will, in principle, be responsible for the management and maintenance of the JKUCAT, full-time maintenance staff should be employed for the maintenance of those facilities relating to electricity, airconditioning, sanitation and special equipment. Moreover, maintenance agreements should be made with the local agents of

the manufacturers to establish a regular maintenance, inspection and repair system for precision teaching equipment. Maintenance staff should participate in equipment installation and test operation to obtain a proper understanding of the facilities and equipment in view of smooth maintenance following the handing over of the new facilities to the Kenyan side.

As previously mentioned, Japanese project-type technical cooperation has also been requested by the Government of Kenya in addition to the provision of facilities and equipment under the Project. The maintenance plan should be prepared with a view to the Kenya side performing the necessary work following the termination of the Japanese technical cooperation in the future.

(2) Facility and Equipment Maintenance Plan

1) Buildings

The main points in regard to building maintenance are daily cleaning, the repair of worn or damaged parts and security to ensure building safety and security.

Daily cleaning has a favourable effect on the attitude of those using the buildings and is also important to maintain the necessary level of cleanliness for the educational facilities. It also leads to the early discovery of damage and equipment breakdown and subsequent early repair, thereby prolonging the life of building service equipment and teaching equipment.

Repair work mainly consists of the repair or renewal of exterior and interior finishing materials which protect the buildings. Based on Japan's experience, it is believed that remodelling or partial rebuilding will be required every 10 years. The regular inspections and repairs required to prolong building life will be described in detail in the maintenance manual to be presented to the Kenyan side at the time of handing over the buildings and are outlined below.

Outline of Regular Building Inspections

(Exterior)	
Repair and repainting of exterior finish	every 5 years
Inspection, repair and repainting of roofs	inspection : annually others : every 5 years
Inspection and repair of roof waterproofing	inspection : annually others : as required
Cleaning of gutters and drainage facilities	monthly
Inspection and repair of waterproofing of exterior doors and window frames	annually
Repainting of exterior doors and window frames	every 5 years
Inspection and cleaning of drainage ditches and manholes	monthly
Repainting of perimeter fencing	every 5 years
Gardening	as required
(Interior)	
Alteration of interior finishings	as required
Repair and repainting of interior walls	as required
Replacement of ceiling materials	as required
Replacement of ceiling materials	as required
Adjustment of doors and windows	annually
Replacement of hardware	as required

2) Building Services

Not only regular operation control and inspection but also the repair and exchange of parts will be required for the proper maintenance of the building services. The service life of building service equipment can definitely be extended by proper operation and regular inspection, adjustment, cleaning and repair. The safety of this equipment must be secured by measures preventing breakdowns and accidents without causing damage to the buildings. Overhauls and the exchange of worn

parts must be conducted pursuant to the maintenance manual at the time of regular inspection.

Maintenance staff must have an exact understanding of the system designs and capacities, etc., so that they can prevent accidents. Full-time maintenance engineers should, therefore, be employed for each of the (i) electricity, (ii) airconditioning, (iii) water supply, drainage and sanitation and (iv) special equipment fields. Moreover, these engineers should undergo on-site training from the equipment installation and test operation stages to obtain a thorough understanding of the equipment for which they are responsible. While maintenance and operation manuals will be provided at the time of project completion, the main service equipment lives service are generally as follows.

Lives of Main Building Services Equipment

Electricity	
Generator	20 – 30 years
Panel	20 – 30 years
Fluorescent Lamps	5,000 – 10,000 hours
Incandescent Lamps	1,000 – 1,500 hours
Telephone Switchboard	40 years
Paging Equipment	15 – 20 years
Water Supply, Drainage and Sanitation	
Pumps, Pipes and Valves	10 – 15 years
Tanks	15 – 20 years
Sanitary Fixtures	25 years
Fire-Fighting Equipment	20 years
Gas Apparatus	10 years
AirConditioning	
Pipes	10 – 15 years
Fans	10 – 15 years
AirConditioners	10 – 15 years

3) Equipment

Many types of equipment will require careful handling in view of their fragility, the use of precision parts and possible adverse effects due to vibration, impact, temperature and humidity, etc.

In view of the above, while users may be responsible for the maintenance of general purpose and simple equipment, the maintenance and repair of that equipment requiring special knowledge and skills should be regularly conducted by specialized engineers. While maintenance manuals giving details of inspection items and inspection frequency will be provided at the time of handing over the equipment to the Kenyan side, regular maintenance work is outlined below.

Outline of Regular Maintenance Work

	Internal Maintenance		External Maintenance
	Cleaning	Inspection	
General Purpose Equipment	monthly	annually	as required
Analysis Equipment	daily	3 times/year	annually
Optical Equipment	daily	3 times/year	annually
Precision Equipment	daily	twice/year	as required
Audiovisual Equipment	monthly	annually	as required
Printing Equipment	daily	monthly	as required
Agricultural Machinery	monthly	twice/year	annually

(3) Maintenance Cost Estimate

The maintenance costs of JKUCAT in the initial year (1989/90) and the target year (1994/95) of the Project is separately estimated here, and the costs are classified into the personnel cost, building services cost, direct maintenance cost and expendables cost.

A. Initial Year of the Project (1989/90)

1) Personnel Cost

The personnel cost at the time of the commencement of the Project (1989/90) is estimated as follows based on the personnel plan of the Kenyan side. The average salaries are based on Kenyan data and a 10% increase is

assumed before 1989/90.

Teaching Staff	persons (136)	732,300	K£/year
Non-Teaching Staff	(100)	225,000	K£/year
Officers (C6 or above)	(50)	235,000	K£/year
Ordinary Staff (C5 or below)	(203)	304,500	K£/year
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Total	(489)	1,496,800	K£/year

2) Building Services Cost

The annual cost of such building services as electricity, telephones, water and LPG is estimated based on the average daily use.

① Electricity Cost

(a) Maximum Power Demand

The load capacity of the JKUCAT will be approx. 200 KVA and max load capacity of approx. 250 KVA is planned.

(b) Monthly Power Consumption Volume

Existing facilities

$$375\text{KW} \times 0.7 \times 8 \text{ hrs} \times 20 \text{ days} = 42,000 \text{ KWH/month}$$

New Common Lecture Buildings

$$58\text{KW} \times 0.6 \times 8 \text{ hrs} \times 20 \text{ days} = 5,600 \text{ KWH/month}$$

Water Purification Plant, etc.

$$218\text{KW} \times 0.4 \times 8 \text{ hrs} \times 20 \text{ days} = 14,000 \text{ KWH/month}$$

Total Monthly power Consumption	61,600 KWH/month
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(c) Electricity Cost Estimate

Fixed Fee (Basic fee)	6 K£/month
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Demand Fee	625 K£/month
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Unit Charge ($61,600\text{KWH} \times 0.0485$) = 3,000 K£/month

Total 3,631 K£/month
Annual Electricity Cost: $3,631 \times 12 = 43,600$ K£/year

② Telephone Charge

The local charge is 3Ksh/call and a monthly charge of 1,200K£ is assumed.

Annual Telephone Charge: $1,200 \text{ K£} \times 12 = 14,400$ K£/year

③ Water Purification Maintenance Cost

Maintenance & Operation Personnel Cost	4,500 K£/year
Facilities & Equipment Maintenance Cost	5,000 K£/year
Chemicals Expendable Supplies Cost	24,000 K£/year

Total 33,500 K£/year

④ LPG Cost

(a) Monthly LPG Consumption

$76 \text{ kg/day} \times 20 \text{ days/month} = 1,520 \text{ kg/month}$

(b) Cost estimate

LPG Cost: 0.5 K.£/kg

Annual LPG Cost:

$1,520 \text{ kg/month} \times 12 \times 0.5 \text{ K.£/kg} = 9,100 \text{ K£/year}$

3) Direct Maintenance Cost

① Facility Maintenance Cost

The building repair cost will largely increase with time.

Here, the average annual repair cost over a 30 year span is assumed to be 2 K.£/m².

$2 \text{ K£/m}^2\text{/year} \times 33,976\text{m}^2 = 68,000 \text{ K£/year}$

② Building Services Maintenance Cost

The maintenance cost for the building services will be minimal for the first 5 years. However, parts and equipment replacement will then gradually become necessary. The average annual repair cost over a 10 year span is assumed to be 1.5% of the initial installation cost.

$$1,210,000 \text{ K}\text{\pounds} \times 1.5\%/year = 18,000 \text{ K}\text{\pounds}/year$$

③ Equipment Maintenance Cost

The equipment maintenance cost will be minimal for the first 1 ~ 2 years but will gradually increase with time. Based on the typical case in Japan, the annual cost for the first 5 years and the subsequent 5 years is assumed to be 2% and 4% respectively. The assumed total equipment price is ¥ 90 million.

$$\text{First 5 years: } ¥ 90,000,000 \times *0.5 \times 2\% = ¥ 90,000/year \\ (6,500 \text{ K}\text{\pounds}/year)$$

*ratio of equipment requiring maintenance work

④ Cleaning and Security Cost

Included in 1), Personnel Cost.

4) Expendables Cost

The actual cost will largely vary depending on the extent of the activities. The equipment utilization rate is assumed to be 50% of the average rate in Japan.

19,700 K.£/year

5) Estimated Total of 1) to 4)

1) Personnel Cost	1,496,800K.£/year
2) Building Services Cost	100,600K.£/year
3) Direct Maintenance Cost	92,500K.£/year
4) Expendables Cost	19,700K.£/year

Grand Total

1,709,600K.£/year

The annual maintenance cost for JKUCAT is estimated to be 1,709,600 K.£, which is equivalent to approx. ¥ 239 million.

B. Target Year (1994/95)

1) Personnel Cost

The personnel cost at the time of the commencement of the Project (1994/95) is estimated as follows based on the personnel plan of the Kenyan side. The average salaries are based on Kenyan data and a 10% increase is assumed before 1990/91.

	persons		
Teaching Staff	(232)	1,770,000	K£/year
Non-Teaching Staff	(262)	776,000	K£/year
Officers (C6 or above)	(77)	543,000	K£/year
Ordinary Staff (C5 or below)	(361)	813,000	K£/year
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Total	(932)	3,902,000	K£/year

2) Building Services Cost

The annual cost of such building services as electricity, telephones, water and LPG is estimated based on the average daily use.

① Electricity Cost

(a) Maximum Power Demand

The load capacity of the JKUCAT will be approx. 420 KVA.

(b) Monthly Power Consumption Volume

Existing Facilities	61,600 KWH/month
Lighting and Outlets	16,300 KWH/month
Air-Conditioning and Power	18,400 KWH/month
Research and Training Equipment	4,800 KWH/month

Student Hostels	15,400 KWH/month
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Total	116,500 KWH/month

(c) Electricity Cost Estimate

Fixed Fee (Basic fee)	6 K£/month
Demand Fee	1,050 K£/month
Unit Charge	5,650 K£/month
<hr/>	
Total	6,706 K£/month

Annual Electricity Cost: $6,706 \times 12 = 8,500$ K£/year

② Telephone Charge

The local charge is 3Ksh/call and a monthly charge of 2,250K£ is assumed.

Annual Telephone Charge: $2,250 \text{ K£} \times 12 = 27,000$ K£/year

③ Water Purification Maintenance Cost

Refer to A. Initial Year of the Project (1989/90) for detail.

33,500 K£/year

④ LPG Cost

(a) Monthly LPG Consumption

$130 \text{ kg/day} \times 20 \text{ days/month} = 2,600 \text{ kg/month}$

(b) Annual LPG Cost:

$2,600 \text{ kg/month} \times 12 \times 0.5 \text{ K.£/kg} = 15,600 \text{ K£/year}$

3) Direct Maintenance Cost

① Facility Maintenance Cost

The building repair cost will largely increase with time.

Here, the average annual repair cost over a 30 year span is assumed to be 2 K.£/m².

$$2 \text{ K.£/m}^2/\text{year} \times 45,208\text{m}^2 = 90,400 \text{ K.£/year}$$

② Building Services Maintenance Cost

The maintenance cost for the building services will be minimal for the first 5 years. However, parts and equipment replacement will then gradually become necessary. The average annual repair cost over a 10 year span is assumed to be 1.5% of the initial installation cost.

$$186,000\text{K.£} \times 1.5\%/\text{year} = 28,000 \text{ K.£/year}$$

③ Equipment Maintenance Cost

The equipment maintenance cost will be minimal for the first 1 ~ 2 years but will gradually increase with time. Based on the typical case in Japan, the annual cost for the first 5 years and the subsequent 5 years is assumed to be 2%. The assumed total equipment price is ¥ 368 million.

$$\text{First 5 years: } \text{¥ } 368,000,000 \times *0.5 \times 2\% = \text{¥ } 3,680,000/\text{year} \\ (26,300 \text{ K.£/year})$$

*ratio of equipment requiring maintenance work

④ Cleaning and Security Cost

Included in 1), Personnel Cost.

4) Expendables Cost

The actual cost will largely vary depending on the extent of the activities. The equipment utilization rate is assumed to be 50% of the average rate in Japan. 39,300 K.£/year

5) Estimated Total of 1) to 4)

1) Personnel Cost	3,902,000K.£/year
2) Building Services Cost	156,000K.£/year

3) Direct Maintenance Cost	144,700K.£/year
4) Expendables Cost	39,300K.£/year
Grand Total	4,242,000K.£/year

The annual maintenance cost for JKUCAT is estimated to be 4,242,000 K.£, which is equivalent to approx. ¥ 593.8 million.

3.4 Technical Cooperation

The technical cooperation requested by the Kenyan side is as follows:

(1) Technology Transfer by Long-Term JICA Experts and JOCVs (see List of Requests for JICA Experts and JOCVs)

- technical instruction and advice for counterparts
- cooperation in preparation of curricula, syllabuses and teaching materials
- advice on educational, research and development and academic activities

(2) Cooperation for Overseas Training of JKUCAT Lecturers (see List of Requested Overseas Training of JKUCAT Lecturers)

- training in Japan on scholarships of the Japanese Ministry of Education
- training in third countries
- training at domestic institutions in Kenya
- JICA training
- attendance at company training courses

(3) Provision of Teaching and Research Equipment

The fields of specialization of experts considered for long term dispatch in response to the foregoing request are as follows:

- Academic Adviser
- Team Leader
- Assistant Team Leader/Coordinator
- Assistant Coordinator
- Horticulture
- Agricultural Engineering
(Agricultural Civil Engineering)
- Agricultural Engineering
(Agricultural Machinery)
- Food Engineering
- Postharvest Technology
- Farm Management-Cultivation
- Maintenance of Agricultural
Machinery
- Civil Engineering
- Architecture
- Mechanical Engineering
(Automobile, Prime Mover)
- Mechanical Engineering
(Production Engineering)
- Electrical Engineering
- Electronics Engineering

CHAPTER 4 BASIC DESIGN

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4.1 Basic Design Policies

As project implementation is planned while the existing facilities are in use, the operation of these existing facilities must not be disturbed.

In view of the above, the following Basic Design policies have been adopted.

1. Since further facility expansion is expected in the Revised JKUCAT Master Plan (1989 - 2000) in accordance with the college's upgrading to university status, the overall facility distribution should be capable of responding to facility expansion in the future in view of the systematic location of the facilities.
2. Maximum consideration should be given in the basic plan to the locations of the new buildings and construction roads to minimize any disturbance of the teaching activities of JKUCAT which will continue throughout the project implementation period.
3. The Basic Design should give priority to economy by the adoption of facilities with a low maintenance cost while taking the environmental conditions of the project site, the functionability and durability of the new facilities into consideration.

The following points should be noted in the preparation of the Basic Design in view of the natural conditions of the project site.

4. The project site enjoys a comfortable mean temperature of 17 - 22°C throughout the year with humidity of 50 - 70%. Under these conditions, comfortable room conditions can be maintained by planning natural ventilation without relying on mechanical ventilation. Therefore, the maximum use of natural ventilation should be considered.
5. While the average annual rainfall at the project site is 900 - 1,000mm, heavy rainfall often occurs in the rainy seasons. A drainage system capable of dealing with heavy rainfall should be planned.

6. The Kenyan Ministry of Public Works classifies Kenya into zones in terms of possible earthquake strength. The project site belongs to Zone VII which requires no special measures vis-a-vis earthquakes.
7. As lightning frequently occurs in the rainy seasons, causing considerable damage, protection measures vis-a-vis lightning should be introduced for the facilities.

4.2 Design Conditions

4.2.1 Planned Facilities

The Expansion Project consists of the construction of the following facilities.

I Common Facilities

1 Faculty of Agriculture

laboratories and workshops (plant nutrition; environmental control; food biochemistry; microbiology; postharvest technology; irrigation and drainage; agricultural machinery), soil sterilization room, lecture room, drawing room and lecturers' rooms, etc.

2 Faculty of Engineering

laboratories and workshops (physical environment; architectural moulding and modeling, digital; control; illumination; electrical measurement; telecommunications; construction material testing; thermo-dynamics; metrology; fluid engineering), lecture room, drawing rooms, lecturers' rooms and machinery hardstanding, etc.

3 Common Lecture Building

laboratories (physics; chemistry; biology), computer room, lecture rooms and lecturers' rooms, etc.

4 Water Purification Plant

5 Library

reading room, book stacks, reference room, offices and workrooms, librarian's room, etc.

6 Resource Centre

printing room, offices and audiovisual room, etc.

II Administration Section

Provisional Lecturer's Room, University College Council Chairman's office, Principal's office, Deputy Principal's office, other offices, conference room and maintenance workshop, etc.

III Canteen and Kitchen

canteen and kitchen, etc.