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No. 70

ケニヤッタ農工大学事前調査チーム
報 告 書
(付属資料)

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I. 教員養成計画（ケニア側作成）

CONF/T/54/92

9th September, 1978

Mr. K. Kumagai,
Embassy of Japan,
P.O. Box 20202,
NAIROBI

JOMO KENYATTA COLLEGE OF AGRICULTURE AND
TECHNOLOGY STAFF DEVELOPMENT

Forwarded herewith is a draft of consolidated numbers of trainees for teaching staff for the above mentioned college as per your suggestion.

As indicated earlier we have stressed the need to train three persons for one post to alleviate the problem of loss of staff to industry.

Recruitment would only involve the basic requirement but extended over a period of three years to complete the total training envisaged.

I suspect further details will be forthcoming after our discussion in Japan.

(E.A. WANCAI)
for: PERMANENT SECRETARY

STAFF TRAINING REQUIREMENT

A. FACULTY OF AGRICULTURE

1. Department of Horticulture

As there is no horticulture training to degree level in Kenya it will be necessary to recruit graduates of agriculture and send them overseas for post graduate training in various specialist subjects. Such graduates with field experience are already available in the country and should be recruited as soon as possible to meet the deadline date of March/June 1981 when the college will commence full training programmes.

The following specialist staff for the teaching of Horticulture Courses were agreed upon by members of the Japanese Mission and Egerton Staff:-

- i. Industrial Crops
- ii. Entomology
Plant Pathology - Crop Protection
- iii. Plant Breeding
Plant Nutrition
- iv. Pomology
- v. Olviculture
- vi. Floriculture
- vii. Economics and Farm Management.

The lecturer in Economics and Farm Management (preferably including extension) could be trained locally at the Faculty of Agriculture - University of Nairobi.

If trained locally, he can commence his/her studies in 1979 for two years and be available by June 1981.

All workshop technicians are available locally, they would be holders of Diploma in Horticulture or Certificate in Agriculture.

2. Department of Agricultural Engineering

The following specialist areas for lecturers were also agreed upon as above:-

- i. Plant layout, Processing and Electricity - 2 BSc/MSc.
 - ii. Farm Power (previously 1) - 2 BSc/MSc.
 - iii. Farm Machinery - 1 MSc.
 - iv. Soil and Water Conservation - 2 BSc/MSc.
 - v. Structures and Drawing - 1 BSc.
 - vi. Workshop - 1 BSc.
 - vii. General Courses to be taught by staff from other departments.
- a) Agricultural graduates should be recruited for post graduate courses i, ii, iii, iv.
 - b) Holders of Diplomas in Agricultural Engineering should be recruited and sent for undergraduate training in 1979 for areas iii, v, and vi.

It is hoped they will obtain some credit for courses already taken at Diploma level at Egerton College so that they can complete their programmes in 1980/81. However if graduates in Mechanical Engineering are available (which is doubtful) the same programme as for items i, ii, iii, iv. in (a) should be followed.

3. Farm Manager

He/she can be recruited locally and should immediately be available. A good Diploma in Farm Management together with 3 years practical experience is a suitable criterion for selection. He should proceed for 3 - 6 months in Japan for training programme in Farm Management.

4. Department of Food Processing

- a) Diploma holders from Egerton College should be recruited and given scholarships for Higher Diploma courses in specific area i.e. Meat and meat products, Milling and Baking, Fruit and Vegetables.

They should also be given 3 - 6 months work experience.

- b) University graduates in Food Technology should be sent out for post graduate work in Food Technology with emphasis on the three areas mentioned above.

Numbers of Trainees

Due to high loss of personnel to other industries it is strongly recommended that three trainees be recruited for every post required i.e. if we are to fully staff this college with Kenyans.

This training should be staggered over a number of years starting early 1979.

B. FACULTY OF ENGINEERING

1. Mechanical Engineering Department

i. Motor Vehicle Course Staff

- a) Motor vehicle technicians with Part II Certificates should be offered scholarships to take Part III course which involves-

- advanced motor vehicle workshop practice.
- management
- servicing
- Administration and organisation.

This course should be followed by Industrial experience.

- b) University graduates in Mechanical Engineering should be recruited to take masters degree with particular reference to mechanically propelled machinery.

ii. Agricultural Machinery Engineering

- a) Full sponsorship is required for technicians in Agricultural Mechanics. There is a definite shortage of staff to train this cadre in Kenya.

As an interim measure attempt should be made to offer training to motor vehicle technicians with Part II Certificate a 1 - 2 years intensive course in agricultural machinery with special reference to agricultural machinery maintenance and repair.

- b) University graduates in mechanical engineering should be given scholarships for Diploma in Agricultural Machinery Engineering.

Alternatively university graduates in Agriculture should be offered a post graduate course (masters degree) in Agricultural Machinery Engineering.

It is suggested that both routes be taken.

iii. Construction Plant Engineering

- a) Mechanical Engineering technicians with Part II Certificate or Ordinary Diploma (mechanical) should be sponsored for construction Plant Engineering courses to include both Parts II & III.

- b) University graduates in mechanical engineering should be sponsored for an intensive course covering, among other aspects, industrial experience in maintenance workshops, field work with heavy earth moving equipment, organisation and administration.

2. Electrical Engineering Department

i. Electrical Engineering

- a) Electrical Engineering Technicians with Ordinary Diploma or Technician Certificate Part II or preferably Full Technological Certificates should be recruited for Higher Diploma courses supplemented by 4 - 6 months of industrial experience.
- b) University graduates in electrical engineering should be offered scholarships for masters degree supplemented also by industrial experience.

ii. Electronics Engineering

- a) Candidates with similar basic qualifications as in 2(i) (a) above should be given scholarships for Higher Diploma in Electronics Engineering plus related industrial experience.
- b) University graduates in electrical engineering should be recruited for masters degrees with specialisation in electronics engineering.

Industrial experience is also necessary.

3. Building Engineering Department

i. Irrigation Engineering

- a) Sponsor candidates with Ordinary Diploma in Water Engineering course for Higher Diploma in Water Engineering.
- b) Sponsor university graduates with BSc. in Water Engineering or Hydrology or Civil for past graduate course in Irrigation Engineering.
- c) Sponsor A - level candidates locally or overseas to pursue specialised course in Irrigation Engineering including Water Supply and Public Health Engineering. The University training to be followed by industrial attachment.

ii. Construction Technician

- a) Sponsor candidates with Ordinary Diploma in Building OR Construction Technician Certificate Part II for Higher Diploma.

3 to specialise in Concrete Technology

3 to specialise in Building Services, and Plumbing Technology.

4 to specialise in Wood Technology.

- b) Recruit university graduates in Building Economics for post graduate work and industrial experience.
- c) Sponsor A - level candidates for undergraduate work specialising in Building Technology.

Their course should be followed by industrial attachment on Building Site.

iii. Architectural Technician

- a) Sponsor candidates with Ordinary Diploma in Building for Higher Diploma in Architectural Draughting.
- b) Sponsor university graduates in Architecture (B. Arch.) for masters degree in Architecture. This should incorporate industrial attachment. If candidates with masters degree are available they should be recruited for work and industrial experience.
- c) A - level candidates should be sponsored locally or overseas for a five year graduate course in Architecture.

C. WORKSHOP AND LABORATORY TECHNICIANS

Faculty of Agriculture

- i. All technicians for Horticulture and Agricultural mechanics are available locally. They would be holders of Diploma in Horticulture or Certificate in Agriculture. They however should be given study tour (6 - 12 months) in Japan in relevant field.
- ii. Laboratory technicians for Food Processing laboratories can also be trained locally. Candidates with mechanical engineering technician certificate Part II and Electrical Technician Part II should be sponsored for course in Food laboratory practice.

Alternatively holders of Diploma in Food Technology should be recruited and offered a study tour in relevant field.

Faculty of Engineering

- i. Holders of Technician Certificate Part II in mechanical, motor vehicle, Electrical and Electronics should be sponsored for an intensive course in Japan with main emphasis in workshop practice, maintenance and repair of workshop machinery, tools, equipment and instruments.

The course should take at least 10 - 12 months.

Preferred candidates (if available) would be those holding Technician Certificate Part III or Full Technological Certificate.

- a) Holders of Ordinary Diploma in Water Engineering should be recruited and sent overseas for a one year training in field and laboratory work and practice.
- b) Holders of construction technician certificate Part II should be sponsored for 10 - 12 months in workshop and laboratory practice.

- c) Holders of Diploma in Building or construction technician certificate Part II should be sent out for Architectural Draughting course. This may require at least 2 years.

(E.A. WANGAI)

MINISTRY OF EDUCATION.

(1)

JOMO KENYATTA COLLEGE OF AGRICULTURE AND TECHNOLOGY
STAFF TRAINING REQUIREMENT

FACULTY OF AGRICULTURE

<u>DEPARTMENT</u>	<u>COURSE</u>	<u>No. REQUIRED</u>	<u>No. TO TRAIN</u>	<u>PERIOD YEARS</u>	<u>SUBJECT/REMARKS</u>
Horticulture	Industrial Crops	1	3	2	Industrial Crops
	Crop Protection	1	3	2	Entomology Plant Pathology
	Plant Breeding	1	3	2	Plant Breeding Plant Nutrition
	Pomology	1	3	2	Pomology
	Oliviculture	1	3	2	Oliviculture
	Floriculture	1	3	2	Floriculture
	Economics and Farm Management	1	3	2	Farm Management

(2)

Agricultural
Engineering

Plant Layout, Processing & Electricity	2	6	2
Farm Power	2	6	2
Farm Machinery	1	3	2
Soil & Water Conservation	2	6	2
Structures & Drawing	1	3	2
Workshop	1	3	2

(3)

Food

Processing

Food technology
(Higher Dip)

5

Higher Dip Course

5 - 3

15

specializing in-

5 - Meat & Meat

Products

5 - Milling & Baking

5 - Fruit & Vegetables

Food Technology

4

2

12

- MSC. Food Tech.

in the 3 area.

(4)

FACULTY OF ENGINEERING

Motor Vehicle	Motor Vehicle	4	12	2 yrs.	Motor Vehicle Part III (M.V. Practice, managements Servicing, Administration and organisation)
Engineering	Mechanical Engineering	2	6	2 yrs.	Masters degree (Mechanically propelled machinery)
Agricultural machinery	Agricultural Mechanics	4	12	3 yrs.	Agricultural Mechanics
	Agricultural Machinery Mechanics	2	6	2 yrs.	3 - Masters in Ag. Machine Engineering 3 - Diploma in Ag. Mach. Engineering.
Construction Plant Engineering	Construction Plant Technician	4	12	3 yrs.	Construction Plant Technician Parts II & III
	Construction Plant Engineering	2	6	18 months.	Industrial experience in maintenance workshop heavy earth moving equipment organisation & administra- tion.

(5)

Electrical Engineering	Higher Diploma (electrical)	5	15	2 + 1 yr.	Higher Diploma in Electrical engineering plus 4 - 6 months industrial experience
	Electrical Engineering	3	9	3 - 2 yr. 6 - 10 mo.	Masters degree Industrial training
Electronic Engineering	Higher Diploma (electronics)	5	15	2 + 1 yr.	Higher Diploma in Electronic Engineering plus 4 - 6 mo. industrial experience.
	Electronic Engineering	2	6	4 - 2 yr. 2 - 10 mo.	Masters Degree Industrial training.

(6)

Building & Civil Engineering	Irrigation Engineering	8	24	8 - 2 8 - 3+1	Irrigation Engineering (Irrigation Engineering water supply Public Health Engineering. Water Engineering
	Construction Technician	8	24	8 - 2 6 - 3+1 10 - 3	Building Economics Building Technology 3 - Concrete Technology 3 - Building Services & Plumbing Technology 4 - Wood Technology
	Architectural Technician	8	24	8 - 2 8 - 4+1	Post Graduate B. Arch. + Industrial experience Higher Diploma Architec- tural Draughting

(7)

WORKSHOP/LABORATORY TECHNICIANS

FACULTY OF AGRICULTURE

<u>DEPARTMENT</u>	<u>COURSE</u>	<u>No. REQUIRED</u>	<u>No. TO TRAIN</u>	<u>PERIOD YEARS</u>	<u>SUBJECT/REMARKS</u>
Dept. of Horticulture	Crops Production & Lab. technicians	5	15	1 yr.	
Dept. of Agricultural Engineering	Agricultural Farm Engineering	7	21	1 yr.	Farm management. Repair & Maintenance of farm implements and machinery.
Dept. of Food Processing	for laboratory technicians for - Meat & Meat products - Milling & Baking - Fruit and vegetables.	6	18	1-2 yr.	Laboratory practice Ability to maintain and repair basic equipment.

FACULTY OF ENGINEERING

Dept. of Mechanical Engineering	Agricultural Machinery Engineering	3	9	1 yr.	Agricultural Machinery Maintenance and Repair.
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「教員養成計画」概要

		レクチャラー	人数	テクニシャン	人数	
農学部	園芸学科	大卒の者を海外へ2年大学院留学	7名	ディプロマレベルをケニアで養成及び6～12ヶ月の日本における研修	5名	
	農業工学科	大卒の者を大学院へ2年	7名	"	7名	
		ディプロマレベルを大学へ(2年)	2名			
	食品加工学科	大卒の者を大学院へ2年	4名	パートⅡあるいはディプロマレベルをケニアで養成及び研修旅行	6名	
	農場長	ディプロマレベルをハイアードイプロマへ	5名			
		ディプロマ及び3年の実務経験者を日本へ3～6ヶ月	1名			
		小計	26名	小計	18名	
	養成計画人数	$(7+7+2+4+5) \times 3 + 1 = 76$ 名		$(5+7+6) \times 3 = 54$ 名		
工学部	機械工学科	自動車	大卒の者を修士取得の為2年	2名	PartⅠの者を日本において1年研修	9名
			PartⅡの者をPartⅢ取得の為2年	4名		
		農業機械	大卒の者を修士取得の為2年	1名		
			大卒の者をディプロマ取得の為2年	1名		
			PartⅡの者を保護管理の研修1～2年	4名		
			PartⅡ及びディプロマの者をPartⅢに	4名		
		小計	18名			
	電気工学科	電気	大卒の者を修士取得の為2年及び企業内訓練半年	3名	PartⅡの者を日本において1年研修	5名
			ディプロマ及びPartⅡの者をハイアードイプロマ取得の為2年及び企業内訓練1年	5名		
		電子	大卒の者を修士取得の為2年及び企業内訓練2～10ヶ月	2名		
		ディプロマ及びPartⅡの者をハイアードイプロマ取得の為2年及び企業内訓練1年	5名			
	小計	15名				

		レクチャラー		養成人数 定員		テクニシャン		養成人数 定員		
工 学 部	建築土木学科	かんがい	大卒の者を大学院へ2年及び企業内訓練	8名	8	}	ディプロマの者を海外へ1年 実習・実験室の研修	9名	3	
			Aレベルの者を大学へ3年及び企業内訓練	8名						
			ディプロマの者をハイアーディプロマへ3年	8名						
	建設	大卒の者を大学院へ2年及び企業内訓練	8名	8	}	Part II の者を実習・実験室の研修に1年	6名	2		
Aレベルの者を大学へ3年及び企業内訓練		6名								
ディプロマ及びPart II の者をハイアーディプロマへ3年		10名								
建築	大卒の者を修士取得の為、2年及び企業内訓練	8名	8	}	ディプロマの者を製図研修のため2年	3名	1			
	Aレベルの者を国内及び海外の大学及び大学院へ5年	8名								
	ディプロマの者をハイアーディプロマへ3年	8名								
		小 計	24名			小 計	6名			
養成計画人数		機 械 工 学	(2 4 1 1 4 2 4) 3 [※] =	54名			9×3 [※] =	27		
		電 気 工 学	(3+5+2+5) × 3 [※] =	45名			5×3 [※] =	15		
		建 築 土 木 学	(8+8+8+8+6+10+8+8+8) =	72名			(9+6+3) =	18名		
		計		171名			計	60名		

※ 定着率が悪い為、定員の3倍を養成したいとしている。

II. カリキュラムとシラバス（ケニア側作成英文）

6 September, 1978

Japan International Cooperation Agency (JICA)
PO Box 10542
NAIROBI

Thro'

Embassy of Japan
PO Box 20202
NAIROBI

Dear Sir,

Submitted herewith is the response from Kenya working group on the questionnaire handed from you.

A number of questions cannot be answered at this juncture until further discussions are held between the Ministry of Finance and Planning (Treasury) and representatives of the Government of Japan (i.e. The Japanese Embassy in Kenya). This pertains particularly to the terms and privileges of Japanese experts for the Jomo Kenyatta College of Agriculture and Technology.

Forwarded herewith also are copies of syllabuses that have already been submitted to the Japanese Survey Team Leader for the JKCAT.

They include syllabuses for

Engineering Faculty

- Agricultural Engineering Technician Parts I, II, III Course
- Motor Vehicle " Parts I, II, III,
- Construction Plant Technicians Parts I, II, III.
- Electrical Installation Technician
- Electronic Engineering Technician
- Architectural Technician
- Irrigation Engineering Technician.

Agricultural Faculty

- Agro - Mechanical Engineering (includes equipment list)

- Horticulture.
(includes equipment list).

Remaining syllabuses will be submitted in due course.

(E.A. Wangai)
for PERMANENT SECRETARY

II-1 農学部 園芸学科

JOMO KENYATTA COLLEGE OF AGRICULTURE AND TECHNOLOGY

DIPLOMA IN HORTICULTURE COURSE

DESCRIPTION

YEAR 1 TERM 1

HOME032 : PLANNING FOR BETTER FAMILY LIVING:

Responsibilities of marriage and parenthood; the biological, social, and economic aspects of family life; the processes involved in organization and reorganization of a family; different approaches to family planning; emphasis on the relation between family size and resources.

Lecture - 10 hrs; C.F. 2
Y1 T1

BIO 211 : AGRICULTURAL BOTANY:

A review of the plant Kingdom; essentials of flowering plant taxonomy; origins of crop plants; anatomy and morphology of selected crops; floral biology, sexual reproduction and seed formation; the plant cell and its organelles; enzyme catalysis; carbohydrate metabolism, respiration and photosynthesis; the plant and water; mineral nutrition and nitrogen metabolism; the physiology of growth and development.

Lecture/Practical 30/30 hrs; C.F. 4
Y1 T1

CHEM 311 : PHYSICAL CHEMISTRY:

Laws of Chemical combinations; Atomic and Molecular theories; Periodic classification of elements; Chemical bonding; Solutions; Acidity and alkalinity; Electrolysis; Ionic theory; Redox reactions; Thermochemistry; Energy relations and kinetics of chemical reactions; the colloidal state; and Radioactivity.

PRACTICAL: Common analytical operations; the analytical balance; qualitative analysis of unknown chemical samples; volumetric analysis; acidimetry and alkalimetry; redox titrations; gravimetric analysis; instrumental methods.

Lecture/Practical 20/20 hrs; C.F. 3
Y1 T1

CROPS 431 : CROPS WORK:

Manual work to support the Department's programme of demonstrations, plus work in students own plots.

Practical - 30 hrs; C.F. 1
Y1 T1

ECON 611 : PRICE THEORY & MARKET FORMATION:

The organization of an economic system, demand, supply and market price under pure competition and the factors that affect them/ individual consumer demand the utility approach and the indifference curve approach. Market Classifications and the demand curve faced by the firm.

Lecture - 20 hrs; A.C.F. 2
Y1 T1

ENGINE 814 : ELEMENTARY SKETCHING:

Use of sketching to illustrate ideas; isometric and perspective sketching; line, circle, and ellipse construction, proportioning, lettering; introduction to elementary building plans.

Lecture/Practical - 10/20 hrs; C.F. 2
Y1 T1

ENGINE 841 : TRACTOR SERVICING AND OPERATION:

Maintenance of tractors and operation with and without associated implements; emphasis on daily and weekly servicing; introduction to hydraulic systems.

Lecture/Practical - 10/20 hrs; C.F. 2
Y1 T1

YEAR I TERM II

BIO 214 : ECOLOGY:

The principles of ecology; ecosystems, plant communities; food webs and trophic levels; energy flow; biogeochemical cycles; environmental factors; populations; succession; zones of ecological potential and physiognomic vegetation types in Kenya; land use in the different zones; applied ecology; conservation; pollution; the environmental crisis.

Lecture - 20 hrs; C.F. 2
Y1 T2

BIO 224 : AGRICULTURAL ENTOMOLOGY:

Classification of orders and notable families of insect pests common in Kenya. External morphology in relation to environment and habits. Structure and function of principal organs and systems of a typical insect. Assessment of damage to crops and livestock; control methods; direct, biological and cultural.

Lecture/Practical - 30/20 hrs; C.F. 3
Y1 T2

BIO 213B : PLANT TAXONOMY FOR HORTICULTURE:

The theory is mainly the same as BIO 213A but in the practical work emphasis is placed on cultivars of horticultural crops and ornamentals, and weed species.

There is one trip to visit Nairobi City Parks and the National Arboretum.

Lecture/Practical 20/30 hrs; C.F. 3

Y1 T2

CROPS 412A : PRINCIPLES OF CROP PRODUCTION:

Crop ecology; land preparation, weeds and weed control; planting, spacing, rotation, nursery, plant propagation, mulching, manuring, fertilizers, irrigation, pests and disease control, grain storage.

Lecture - 50 hrs; C.F. 5

Y1 T2

CROPS 431 : CROPS WORK:

Manual work to support the Department's programme of demonstrations, plus work in students' own plots.

Practical - 30 hrs; C.F. 2

Y1 T2

EDUC 711 : INTRODUCTION TO LANGUAGE COMMUNICATION:

Meaning of Communication; forms of communication, e.g. spoken language, written language, communication by signs; Speech-making; Forms of public address e.g. lectures, debates; Choice of topic and the level of audience; Effective conclusion; Prepared and unprepared speech; Code switching and code mixing in language communication; Introduction to language writing; Translation of texts.

Lecture - 30 hrs; C.F. 3

Y1 T2

ENGINE 823 : WORKSHOP FABRICATION:

Introduction to wood and metal fabrication and assembly techniques; proper use and tool selection; introduction to fasteners such as: bolts, rivets, nails screws, glue and welding.

Lecture/Practical - 10/30 hrs; C.F. 2

Y1 T2

YEAR I TERM III

HOMECE 041 : INTRODUCTION TO HUMAN NUTRITION:

An introductory course to principles of human nutrition and world food problems with emphasis on East Africa; nutrients and their sources; this is to include: Energy requirements and metabolism, proteins, minerals and vitamins, their functions, sources and requirements in the diet; nutritional needs of family members with emphasis on malnutrition in children, its symptoms cause and cure, different methods of assessments of nutritional status; introduction to the methods of assessment of nutritional status; causes of food poisoning; and budgeting of the family.

Lecture/Practical 20 hrs; C.F. 2
YI T3

CHEM 322 : SOIL GENESIS, PHYSICS:

LECTURE: Pedology and Edaphology; Scientific bases of soil study; meaning and origin of parent material with special reference to Kenya; minerals of the earth's crust important in soil formation; weathering process and agents; soil forming factors and processes; soil particle classification; soil structure and texture; factors affecting soil structure; soil water; liquid and gaseous losses of soil water and methods of control; factors influencing efficient water use by crops; soil air and temperature and factors promoting their movement in soils; significance of soil air and temperature in crop production.

PRACTICALS: Laboratory study of collected samples of rocks and minerals; methods of identification; laboratory methods of physical and chemical weathering; the role of rocks and minerals and soil formation and their plant nutrient potential. Soil survey for fertility assessment and soil profile study; methods of collecting soil samples and laboratory handling; Methods of soil mechanical analysis and systems of soil particle classification of soils. Laboratory study of drainage and capillarity in soils; methods of assessing different types of soil water (or moisture); soil temperature study in the field; laboratory demonstration of gas production in soils; preparation of soil monoliths; soil consistence determinations.

Lecture/Practicals 20/30 hrs; C.F. 5
YI T3

CHEM 321 : SOIL & FERTILIZER CHEMISTRY - 50/60 hrs.

LECTURE: Soil colloids - clays and humus formation - factors affecting the levels of inorganic and organic colloids in soils; their role in cation exchange process and water holding capacities of soils; soil colloids and heat absorption and conduction; acidity and alkaline production in soils and method of regulation; mineral and organic soils; plant nutrient release; their movement and retention in mineral and organic soils; sources of soil plant nutrients; soil fertility and fertility and fertilizers; fertilizer demand and classification; Manufacture and storage of fertilizer in soils and their selective use in different crops; soil micro-organisms and plant nutrient availability; nutrient fixation and methods of release;

Manures in crop production; classification of manures; methods of preparation and storage; timing of manure application; nutrient and other physico-chemical value of manures.

PRACTICAL: Soil sample collection and preparation; soil fertility assessment including organic matter; cation exchange capacity; soil pH; lime, mineral nutrients; nitrogen forms; exchangeable bases and base saturation; sodium absorption ratio; fertilizer materials; straight and compound fertilizer; detailed analysis of nitrogen, phosphate, potassium, liming and organic materials; methods of interpreting experimental reports; methods of interpreting experimental reports; methods of compounding fertilizers and quantitative assessment of constituent straight fertilizers.

Lecture/Practical - 30/30 hrs. C.F. 5
Y1 T3

CROPS 412A : PRINCIPLES OF CROP PRODUCTION:

Crop ecology; land preparation, weeds and weed control; planting, spacing, rotation, nursery, plant propagation, mulching, manuring, fertilizers, irrigation, pests and disease control, grain storage.

Lecture - 50 hrs; C.F. 5.
Y1 T3

CROPS 432A : FIELD INSTRUCTIONS:

In support of CROPS 412, 418, 421, 423A, 423B; Farm walks to acquaint students with day to day operations on a Farm.

Practical - 30 hrs; C.F. 2
Y1 T3

ECON 613 : PRODUCTION ECONOMICS:

The meaning, purpose and importance of production; factors influencing production and factors of production; factor specialization and its implications for production; production function and the law of diminishing returns; total average and marginal costs; cost minimization and revenue maximization; factor combinations; returns to scale; economics of scale and economic efficiency on the farm; risk and uncertainty and their influence on production; production over time; time and interest; discounting and compounding procedures.

Lecture - 30 hrs; C.F. 3
Y1 T3

ENGIN 846 : POWER AND MACHINERY:

Practical introduction to mounted and trailed implements; i.e. tillage, planting, cultivation and spraying; maintenance and management.

Lecture/Practical - 20/30 hrs; C.F. 3
Y1 T3

RANGE 921 : INTRODUCTION TO RANGE MANAGEMENT:

Range Management as an art and science; its nature and scope; History and relationship to other disciplines; Significance of the course taught in range curriculum, to semi arid problems; the climatic, adaphic, biotic, physiographic and social characteristics of East African rangeland; Range resources; multiple land use in East Africa.

Lecture - 20 hrs; C.F. 2
Y1 T3

YEAR 2 TERM 1

BIO 215 : PLANT PATHOLOGY:

Introductory Microbiology; causes of plant diseases; fungi types, structure, reproduction; types of fungal transmission of plant diseases, bacterial and virus diseases, non-parasitic mineral deficiencies and physiological disorders; Nematodes, insect transmission of plant diseases, control measures-quarantine, hygiene and fungicides.

Lecture/Practical - 30/20 hrs; C.F. 3
Y2 T1

BIO 223 : GENETICS:

Mitotic and meiotic divisions; principles and mechanics of biological inheritance; Mendel's Laws, hybrid crosses; sex linkage, mutations; polyploidy and their agricultural applications; heredity and the environment.

Lecture - 30 hrs; C.F. 3
Y2 Y1

CHEM 331 : ESSENTIALS OF NUTRITION CHEMISTRY:

A combined lecture and laboratory course dealing with the substances and changes involved in nutrition.

LECTURES (40 hrs)

- a) Organic Chemistry; Detection of elements; paraffins; olefins; acetylenes; monohydric alcohols; alkylhalides; ethers; aldehydes and ketones; fatty acids; optical isomerism; dicarboxylic acids; esters; acid chlorides; acid anhydrides; acid amides; amines; alkyl cyanides; benzene; nitro-benzene; phenol; benzaldehyde and benzoic acid.
- b) Animal nutrition; composition of the animal and its food digestion, absorption, transport, storage and utilization of food constituents in the human and animal body; excretion of waste products; energy and biological value of foods; dietary requirements.

LABORATORY (30 hrs)

Composition of organic compounds; the hydrocarbons; organic acids; the alcohols; fats, oils and waxes; aldehydes and ketones; carbohydrates, amines; amides; and amino acids; proteins; enzymes; blood; bones; egg shells; analysis of feeding stuffs.

Lecture/Practical - 40/30 hrs. C.F.
Y2 T1

CROPS 414 PLANT PROPAGATION:

Methods of plant propagation; merits and demerits of sexual and asexual multiplication of horticultural crops; Greenhouse and other plant propagation structures; construction and control of temperature; moisture and light.

Lecture - 40 hrs; C.F. 4.
Y2 T1

CROPS 425B : VEGETABLE GROWING:

Identification and judging of important vegetables with emphasis on taste and quality. Modern vegetable production.

Lecture - 40 hrs; C.F. 4
Y2 T1

a) Organic Chemistry; Detection of elements;

CROPS 432B : FIELD INSTRUCTIONS:

In support of CROPS 414, 415, 416A, 416B, 417, 418, 425B and 426. Farm walks to acquaint students with day to day operations on the Farm.

Practical - 30 hrs; C.F. 2
Y2 T1

CROPS 435 : SPECIAL PROJECTS:

A study of a special area (student's own choice) of crop production under the guidance of a member of staff. The special area of study may be in student's own District. After the study, the student is expected to present a written technical report which will be graded. Length of report not to exceed 10,000 words.

Research/Project - 20 hrs. C.F. 3
Y2 T1

YEAR 2 TERM II

CROPS 416A & B : FLOWER GROWING & LANDSCAPING:

Cultivation of common ornamentals and flowers for home and landscape beautification and for commercial flower production both indoors and outdoors.

An elementary introduction to landscape design and gardening; Application of garden forms, methods and materials to the improvement of gardens and parks.

Lecture - 40 hrs; C.F. 2
Y2 T2

CROPS 418 : PLANT BREEDING:

Theoretical and practical introduction to the purpose and practices of plant breeding; Reproductive System in cultivated plants and plant breeding methods; Genetic basis of breeding self-pollinated crops; Breeding methods with cross-pollinated crops; Breeding for diseases resistance; Polyploidy in plant breeding; Mutation breeding; Distribution and maintenance of improved varieties.

Lecture - 20 hrs; C.F. 2
Y2 T2

CROPS 422 : ANNUAL CROPS:

Maize, sorghum, millets, rice, wheat, Barley, Oats, Cotton, Tobacco, Groundnuts, Potatoes, Beans, Soya, Sunflower, Peas, Simsim, Linseed, Grams.

Lecture - 50 hrs; C.F. 5
Y2 T2

CROPS 432B : FIELD INSTRUCTIONS:

In support of CROPS 414, 415, 416A, 416B, 417, 418, 425B & 426.
Farm walks to acquaint students with day to day operations on the Farm.

Practical - 30 hrs; C.F. 3
Y2 T2

ECON 631 : FARM RECORDS & ACCOUNTS:

Importance of Farm Records; Types of farm records and how to keep suitable records; Accounting procedures; Journalising, ledger, cash analysis and petty cash books; Accounting documents and their use; the balance sheet, trading account and proving accounts and valuation. Performance measures.

Lecture - 30 hrs; C.F. 3
Y2 T2

ENGINE 862 : FARM STRUCTURES:

Farmstead structural requirements; animal and product; space and environmental considerations; basic building construction and material selection.

Lecture/Practical - 20/20 hrs; C.F. 3
Y2 T2

ENGINE 811 : INTRODUCTORY STATISTICS:

Basic concepts of statistical models, distributions, probability, random variables; tests of hypothesis; confidence intervals; regression, correlation, sampling; experimental errors.

Lecture - 20 hrs. C.F. 3 or 2?
Y2 T2

YEAR II TERM III

CROPS 413 : HORTICULTURAL INDUSTRY IN EAST AFRICA:

Scope and development of horticulture as an industry in East Africa, shortcomings and potential for expansion.

Lecture - 20 hrs; C.F. 2
Y2 T3

CROPS 419 : PRINCIPLES OF FIELD EXPERIMENTATION:

An introduction to the use of statistical science in the conduct of agricultural experimentation. The design, execution and analysis of experiments by approved methods.

Lecture - 20 hrs; C.F. 2
Y2 T3

CROPS 423A : PERENNIAL CROPS:

Coffee, Tea, Pyrethrum, Sugar cane, Bananas, Sisal, Cocoa, Coconuts, Passion fruit, Cashew, Pineapple, Citrus, Mango, Macadamia nut, Cassava, Cloves, Wattle.

Lecture - 80 hrs;
Y2 T3

CROPS 426 : FRUIT GROWING:

The growing of Tropical, Sub-tropical and Temperature Fruits other than those covered in CROPS 423A; The growing of Vines and Berries.

Lecture - 60 hrs; C.F. 3
Y2 T3

CROPS 432B : FIELD INSTRUCTIONS (hort):

In support of CROPS 414, 415, 416A, 416B, 417, 418, 425B and 426.
Farm walks to acquaint students with day to day operations on the Farm.

Practical - 30 hrs; C.F. 2.
Y2 T3

ECON 621 : FARM MANAGEMENT:

Principles of farm planning and budgeting; Selecting farm enterprises and planning a rotation programme; the farm layout; the value of farm records for budgeting; planning techniques; gross margin analysis; partial budgeting; complete budgeting including major farm re-organization and planning a new farm; Programme planning; Farm enterprise studies; Performance measures and their application in farm management.

Lecture - 40 hrs; C.F. 4
Y2 T3

EDUC 712 - TECHNICAL WRITING AND REPORTING:

Meaning and scope of technical writing and reporting; Main principles; Types of reports; The techniques of technical writing; Style and presentation; Definitions and multiple meanings and writing a model report.

Lecture - 20 hrs; C.F. 2
Y2 T3

EDUC 751 : INTRODUCTION TO RURAL SOCIOLOGY:

Analysis of human society and the individual as a member of the family the community and other social systems. Rural sociology and its importance; Culture - its importance, cultural change, and effects of the change; Group relations; Kinds of groups and their importance; Social structure and its implications to social change; Power and community decision making process; Social institutions; Social change diffusion and adoption process; Adult learning.

Lecture - 30 hrs; C.F. 3
Y2 T3

ENGINE 851B : SURVEYING, SOIL AND WATER CONSERVATION:

Elementary Surveying: Horizontal distance measuring; differential leveling; land area measurement; plane table; and mapping.

Soil and Water Conservations: General hydrology; water and wind erosion; erosion control practices and structures; water conservation and storage, and water spreading; surface drainage.

Lecture/Practical - 30/30 hrs; C.F. 3
Y2 T3

APRIL - MAY : Field Attachment (See Appendix I)

YEAR 3 TERM I

CROPS 417 : GENERAL CROP PROTECTION IN HORTICULTURE:

Control of diseases and pests as well as other causes of disorders to horticultural crops in East Africa; Chemicals used for spraying and during; Protection of fresh fruits and vegetables in transit.

Lecture - 40 hrs; C.F. 2
Y3 T1

CROPS 423A : PERENNIAL CROPS: Tropical fruits moved to 426.

Coffee, Tea, Pyrethrum, Sugar-cane, Bananas, Sisal, Cocoa, Coconuts, Passion fruit, Cashew, Pineapple, Citrus, Manago, Macadamia nut, Cassava, Cloves, Wattle.

Lecture - 60 hrs; C.F. 8
Y3 T1

CROPS 432B : FIELD INSTRUCTIONS:

In support of CROPS 414, 415, 416A, 416B, 417, 418, 425B and 426. Farm walks to acquaint students with day to day operations on the farm.

Practical - 30 hrs; C.F. 3
Y3 T1

CROPS 432C : PRACTICAL HORTICULTURAL TRAINING:

Intensive practical course at a Research Station in support of CROPS 414, 416A, 416B, 417, 425B, 426.

Practical - 100 hrs; C.F. 3
Y3 T1

Last 2 weeks of field attachment in May.

CROPS 433B : OUTSIDE VISITS:

Day long visits to places of horticultural interest.

Visits - 30 hrs; C.F. 2
Y3 T3

ECON 612 : AGRICULTURAL MARKETING AND POLICIES:

Agricultural marketing and its role in the development of agriculture; Marketing cooperatives and marketing boards with particular reference to East Africa; Government price control and marketing policies; Introduction to international trade and international commodity agreements.

Lecture - 20 hrs; C.F. 2
Y3 T1

EDUC 752 : PRINCIPLES OF EXTENSION EDUCATION:

Role and functions of Extension Education in agricultural and rural developing countries; historical background of the development of extension services and its present organizational structure, scope of work, long and short term goals and problems in relation to the basic principles and philosophy of extension education; the duties and responsibilities of extension educators in comparative or similar system.

Lecture - 20 hrs; C.F. 2 (30 hrs; C.F. 3 for ED)
Y3 T1

YEAR 3 TERM 2

CROPS 412C : SEED PRODUCTION AND TESTING:

Seed production; ecological interaction; certified seed, breeders seed, foundation seed; production of selected crops seeds; reproduction of selected crops, agronomy, harvesting and storage; seed testing, field inspection (cereals, beans, sunflower, etc); sampling seed lots.

Lecture/Practical - 20/10 hrs; C.F. 2
Y3 T2

CROPS 415 : MARKETING OF HORTICULTURAL PRODUCTS:

Market situation; structure and requirements for East Africa horticultural crops; methods of selling; preparation of vegetables and fruits for market and handling and storing produce.

Lecture - 20 hrs; C.F. 2
Y3 T2

CROPS 432B : FIELD INSTRUCTIONS:

In support of CROPS 414, 415, 416A, 416B, 417, 418, 425B and 426.
Farm walks to acquaint students with day to day operations on the farm.

Practical - 30 hrs; C.F. 3
Y3 T2

CROPS 433B : OUTSIDE VISITS:

Day long visits to places of horticultural interest.

Visits - 30 hrs; C.F. 2
Y3 T2

ECON 614 : ECONOMIC DEVELOPMENT:

The meaning, importance, benefits and costs of economic development; important measures of economic development; factors influencing economic development: Land; Land tenure and land reforms; capital; Savings investment and economic growth; the role of consumption; labour: Employment, unemployment and inflation; entrepreneurship: its role in economic development; Investment in human capital; social-political factors and their influence on economic development; the role of agriculture in economic development; agricultural development planning with special reference to the development projects, agricultural credit, irrigation, mechanization, settlement, roads and special rural development projects.

Lecture - 30 hrs; C.F. 3
Y3 T2

EDUC 753 : EXTENSION PROGRAMME PLANNING TEACHING METHODS AND EVALUATION:

The need for the extension programme plan; Principles of extension programme planning and the planning process; Essential elements in the programme planning process and programme implementation; Extension teaching methods and their role in programme implementation; the methods should include individual, group and mass methods; Evaluation of extension programme - principles, purposes and kinds of evaluation.

Lecture - 30 hrs; CF/3
Y3 T2

ENGIN 853 : WATER SUPPLY AND IRRIGATION FOR AGRICULTURE:

Covers general knowledge and appreciation of the technical problems of water supply and irrigation; water development; storage; pumping, piping and management of systems; general requirements of irrigation, application rates, and techniques of application.

Lecture/Practical - 20/30 hrs; C.F. 3
Y3 T2

ENGIN. 855A : OVER HEAD IRRIGATION:

Covers principles and practices of irrigation with coverage of feasibility; site selection; soil and water measurements; design; layout; operation and maintenance of sprinkler systems.

Lecture/Practical - 20/30 hrs; C.F. 4
Y2 T3

ENGIN 855B : SURFACE IRRIGATION:

Covers principles and practices of surface irrigation including site selection, soil and water relationships, design, water conveyance systems; land levelling and surface irrigation structure.

Lecture/Practical - 20/30 hrs; C.F. 4
Y3 T2

YEAR 3 TERM 3

CROPS. 434A & B : SEMINARS:

Agricultural and Horticultural Seminars intended to broaden the students knowledge by participating in the discussions on Agriculture/Horticulture and related subjects.

Seminars - 20 hrs; C.F. 2
Y3 T3

EDUC 756 : GOVERNMENT PROCEDURE:

General Introduction; Government organization and administration; Principles and theories of administration; Important consideration on joining the Government - some preliminary procedural matters to be dealt with at the time of entry; Staff functions and responsibilities.

Lecture - 20 hrs; C.F. 2
Y3 T3

EQUIPMENT, TOOLS AND OTHER FACILITIES

1. Green House 25ft by 100ft.
 inside - mist propagator
 - hot beds
2. Field Laboratory 60 ft x 20 ft
 - seed testing
 - observation for disease and pests
 - other practicals
3. Lath house 150 - 60ft for plants requiring
 partial shade
4. Fruit cage 100ft x 50 ft - to plant crops
 which need protection from pests
 like birds
5. 1 water pump with pipes & sprinklers
6. Water tanks for irrigating vegetables
7. Land - they have 5 acres
 - more is better within which
 they have
 i) a fruit orchard
 ii) Vegetable plots
 iii) Museum for flowers and vegetables
8. Store -/ sprayers
 - jembes - fork
 - plain
 - pangas
 - slashers
 - secateurs
 - rakes
 - garden forks (manure)
 - spades
 - muttocks Jembe/axecombined
 - budding knives
 - watering cans
 pruning knives
 pruning saws
 carpenter saws
 screw drivers
 painting brusges
 measuring cylinders
 chains

files
stone for sharpening
balances
claw hammers
oiling pump
moisture tester
fumigant injector (gun)
vices
polythene bags
" roll
meter rules
microscope
buckets
brooms
gunny bags
hose pipes
karais
wooden trays
seed boxes
screw spanners
measuring tapes
camera
wheel barrows
thermometers
refrigerators - seed storage
sieves - for soil sieving
sprinklers to fit in the hose pipes
chicken wire
hand lenses

F E R T I L I Z E R S

CHEMICALS

CLASSROOMS

APPENDIX I

F I E L D A T T A C H M E N T

A. In order to strengthen the practical skills obtained during course work, the College may arrange "Field Attachment" for students during the long vacation falling in April/May of each year. Depending on the Diploma Course being taken the students may be attached to the following:

1. General Extension (under District Agricultural Officer).
2. Farmers Training Centre or Agricultural Institute.
3. Irrigation Scheme.
4. Dairy Factory.
5. Research Station
6. Agro-mechanical Workshop
7. Large Scale Farms
8. Agricultural Co-operative Societies.

B. During such attachments the students will be expected:

- to work under expert supervision
- to observe experienced personnel
- to carry out any specific assignment or projects given by the College
- write reports for submission to the College
- learn amannual skills
- learn to live and work with people under field conditions.

C. In assessing the performance of field attachment, reports from students as well as supervisors will be made use of. Departmental staff may also visit the students for such assessment.

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II-2 農学部 農業工学科

KENYATTA COLLEGE OF AGRICULTURE AND
ENGINEERING - MUTOMO

DIPLOMA IN AGRO-MECHANICAL ENGINEERING

COURSE DESCRIPTIONS

1. The topics included in the course descriptions are intended to equip the student with the necessary knowledge to help him/her cope with the problems in the field after he/she graduates from the College. Practical aspects of the courses are given great attention in order to offer technical skills required in agricultural engineering field; more than 50% of the time is taken up by practicals for most of the courses. The number of hours assigned to lectures and practicals are shown the end of each course description.
2. Realising that the college will eventually start other courses covering various disciplines in agriculture and engineering, the courses were assigned COURSE NUMBERS which will differentiate courses in different disciplines and also different groups of courses in each discipline. Each course has a classification of three numbers, e.g. ENG 120 (ENGINEERING 120).

The first number is the code relating to particular discipline; i.e. 1 for Agro-mechanical engineering.

The second number is a departmental classification of the subject area of the course as follows:

Agro-Mechanical Engineering

1. Introduction and General
2. Workshop
3. Plant Layout and Electricity
4. Tractors, Farm Power and Machinery
5. Soil and Water Management, and Irrigation
6. Buildings and Structures
7. Students Projects, Outside Visits and Seminars

The third number is the sequence number for courses sharing the same first and second numbers.

3. Abbreviations Y1-T2 (Y1-TII) etc, refer to the year and term when the courses are taught, e.g. Y1-T2 - first year, second term.
4. The final term of each curriculum, i.e. Y3-T3 is scheduled as five teaching weeks although this is a twelve week term; the remaining seven weeks are reserved for revision and examination.
5. The lecture/practical number of hours represent the total number of hours in ten teaching weeks. A course 30 hours represents 3 hours per week.

6. Course outlines will be required in order to define and expand each of the topics in the course description. Course outlines ensure that different lecturers cover the same (minimum) material with the students.
7. Practical topics for each course were not included in the course descriptions. The practicals will depend on facilities and tools and equipment available in the college.
8. Outside visits will be arranged by the particular lecturer taking the course in such a way that the student gains the maximum technical and practical knowledge through such visits.
9. More topics in the course descriptions may be added as need arises. This may be necessary after a follow-up of the first group of diplomates already working in the field.

EGERTON COLLEGE
NJORO
22nd July, 1978

Stephen S. Weru
Dip. Ag. Engr. (Egerton)
B.Sc. Ag. Engr. (Calif.)
M.Sc. Ag. Engr. (Silsoe)
Lecturer-Agricultural
Engineering Department

DIPLOMA IN AGRO-MECHANICAL ENGINEERING

KENYATTA COLLEGE OF AGRICULTURE AND ENGINEERING - MUTOMO

COURSE DISCRIPTIONS

ENG. 111A - MATHEMATICS I

Review on trigonometry and algebra. Introduction to logarithmic functions, exponential functions and slide rule.

Lecture - 30 hrs.

Practical (Problem Session) - 20 hrs.

YI TI (Y stands for YEAR and T stands for TERM)

ENG. 111B - MATHEMATICS II

Introduction to Differential calculus and Intergral calculus. Tangents and normals, Leibnitz theorem, Taylor's Theorem, Area, Volume and Centre of Gravity and applications.

Lecture - 30 hrs.

Practical (Problem Session) - 20 hrs.

YI TII

ENG. 111C - MATHEMATICS III

Introduction to computers: programming, punch card and tape (FORTRAN IV, BASIC). Programme planning, linear programming, critical path analysis, numerical analysis, queuing theory and scheduling of operations.

Lecture - 30 hrs.

Practical - 30 hrs.

YIII TI

ENG. 112 - PHYSICS (APPLIED)

Fundamental principles of physics: work, power and energy, simple machines, pressure, elementary thermodynamics, elasticity, moment of inertia and motion.

Lecture - 30 hrs.

Practical - 20 hrs.

YI TI

ENG. 113A - MECHANICS I

Basic principles of statics: coplanar: parallel force systems and concurrent force system, non-concurrent force system. Non-coplanar: parrallel and concurrent force systems, non-concurrent force system. Centroids and centre of gravity, moment of inertia and friction.

Lecture - 20 hrs.

Practical - 20 hrs.

YI TII

ENG. 113B - MECHANICS II

Basic principles of dynamics, kinematics of rectilinear motion, curvilinear motion, kinematics of rotation, kinetics of rotation, plane motion, impulse momentum and impact.

Lecture - 20 hrs.

Practical - 20 hrs.

YII TII

ENG. 114A - DRAWING I - INTRODUCTION TO FREEHAND SKETCHING

Definition of sketching; freehand sketching working from photographs (photo retouching); pencil work; straight lines, circles, irregular curves, ellipses, regular shapes etc.; theory of lines; layout procedure, (balance proportion, symmetry etc.); principle steps in sketching construction; using the sketch.

Lecture/Practical 10/20 hrs. C.F.2

YI-TI

ENG. 114B - DRAWING II - INTRODUCTION TO DESIGN

Introduction to pictorial views, to include Exonometric, oblique and perspective; development, construction drafting; loci; orthographic projection, introduction to use of instruments, lettering.

Lecture/Practical 20/20 hrs. C.F.3

Y1-T2

ENG. 114C - DRAWING III - WORKING/ASSEMBLY DRAWING

Review of lettering and use of instruments; Dimensioning; sections; conventions; screw threads; fasteners; locking devices; gears and cams; machine drawing working and assembly included; reproduction of drawings exroxing, blue prints etc. included. Introduction to elementary construction drawings.

Lecture/Practical 20/30 C.F.4

Y2-T1

ENG. 115A - SURVEYING I

Elementary techniques of horizontal distance measurement, differential levelling, measurement of direction, compass and compass traversing. Emphasis on use of various surveying equipment and data recording.

Lecture - 20 hrs.
Practical - 30 hrs.
Y1-T1

ENG. 115B - SURVEYING II

Introduction to transit and theodolite surveys, plane table, triangulation, area and volume computations, construction surveying, map drafting and production. Introduction to photogrammetry.

Lecture - 20 hrs.
Practical - 30 hrs.
Y1-T2

ENG. 116 - TECHNICAL REPORT WRITING

Report preparation and presentation of technical data and information: general principles, types of reports style and presentation. Writing a model report.

Lecture - 60 hrs.
Y3-T1

ENG. 117A - STATISTICS I - INTRODUCTION

Introduction to statistics: frequency distribution; averages - arithmetic mean, mode and median; standard deviation; mean deviation; combinations and permutations; variance.

ENG. 117B - STATISTICS II

An advanced course geared to experimental and applied statistics: set theory; probability theory; distribution, experimental design. Sampling; significance levels; mathematical models; analysis of data. Application of statistics in engineering problems.

Lecture - 30 hrs.

Y3-T3

ENG. 120 - METALLURGY

Study of metals: classification of metals, characteristics of metals - physical, chemical and mechanical properties, production of iron and steel, alloys. Recognition of common metals: visual and spark test. Shaping and forming operations, heat treatment of steel - hardening, tempering, normalising, and surface treatment - hard facing and plating.

Lecture - 20 hrs.
Practical - 30 hrs.
Y1-T2

ENG. 121A - WORKSHOP I

Introduction to the correct selection, use and maintenance of wood and metal working hand tools, material selection and layout procedures, workshop layout and safety.

Lecture - 10 hrs.
Practical - 20 hrs.
Y1-T1

ENG. 121B - WORKSHOP II

Introduction to metal working power equipment: drilling machines, power saws and grinders. Emphasis on proper use, adjustment and maintenance of the equipment.

Lecture - 20 hrs.
Practical - 30 hrs.
Y1-T3

ENG. 121C - WORKSHOP III

Introduction to carpentry: hand tools and power equipment. Wood fabrication and assembly techniques. Fasteners - bolts, rivets, nails, screw and glue. Emphasis on correct selection, use, adjustment and maintenance of tools and equipment.

Lecture - 20 hrs.
Practical - 30 hrs.
Y2-T1

ENG. 121D - WORKSHOP IV

The lathe and lathework: types of lathes, lathe tools - use and maintenance. Lathework operations - turning, knurling and thread cutting. Emphasis on correct selection of tools; adjustment and maintenance of the lathe.

Lecture - 20 hrs.
Practical - 30 hrs.
Y2-T2

ENG. 121E - WORKSHOP V

Introduction shaper and milling machines; types of shapers and milling machines, use and maintenance of associated tools. Operations: surface grinding, keyway cutting and gear cutting. Emphasis on use adjustment and maintenance of the machines; safety.

Lecture - 20 hrs.

Practical - 40 hrs.

ENG. 121F - WORKSHOP VI

General course on buildings and structures based on consideration of animal and material loading; space and environmental requirements; availability of building materials; assembly and construction techniques.

Lecture - 20 hrs.

Practical - 30 hrs.

Y3-T2

ENG. 122A - WELDING I

Principles of oxyacetyline welding, bronze welding and soldering. Emphasis on selection of correct welding method and materials. Specialised welding techniques.

Lecture - 20 hrs.

Practical - 30 hrs.

Y1-T3

ENG. 122B - WELDING II

Principles of arc welding: different types of electric welders; characteristics of various types of welding electrodes; welding techniques; strength of welded joints. Emphasis on correct selection of welding method and materials safety.

Lecture - 20 hrs.

Practical - 30 hrs.

Y2-T1

ENG. 122C - WELDING III

Advanced welding techniques: hard facing, cast iron welding; welding of aluminium and alloys; automatic welding machines. Fabrication of welded components; testing of welded joints.

Lecture - 10 hrs.

Practical - 40 hrs.

Y3-T1

ENG. 123 - FORGING

Introduction to forging operations: heating of the metal; forging tools; shaping and forming operations - cold or hot; bending operations. Safety.

Lecture - 20 hrs.
Practical - 30 hrs.

ENG. 124 - CASTING (FOUNDRY WORK)

Design of patterns, melting of metal; and casting. Characteristics and uses of various castings. Plastic and rubber castings and their use in agriculture.

Lecture - 20 hrs.
Practical - 30 hrs.
Y3-T2

ENG. 125 - PLUMBING

Layout and construction of pipe work: types of pipes; pipe measurement and cutting; threading and joining; pipe joints; types of valves. Pipe bending and bending machines.

Lecture - 20 hrs.
Practical - 30 hrs.

ENG. 126 - SHEET METAL

Production of sheet metal; uses of sheet metal; joining of sheet metal - welding, soldering, brazing and reventing. Sheet metal machines.

Lecture - 20 hrs.
Practical - 30 hrs.
Y2-T3

ENG. 127 - WORKSHOP MANAGEMENT

Ordering and coding of stores; inventory; job scheduling and supervision; tools and power machines maintenance schedules. Government workshop safety regulations. Visits to various factories and workshops to be arranged.

Lecture - 20 hrs.
Practical - 30 hrs.

ENG. 130A - ELECTRICITY I

General principles of electricity; electrical circuits - series and parallel; D.C. and A.C. current; resistance, inductance and impedance in electrical circuits; magnetism and electricity - A.C. and D.C. generators (single and 3-phase). Types of electrical motors; motor working principles; electrical switches and control devices. Practicals on measurement, wiring of various electrical devices and machines.

ENG. 130B - ELECTRICITY II

Motor selection and motor protection; motor repair and servicing; lighting design and installation; wire selection and circuit protection. Electrical code. Application of electrical principles and electrical equipment in various operations.

Lecture/Practical - 0/30
Y1-T2

ENG. 131 - PLANT LAYOUT

Analysis of workshop planning and arrangement based on considerations of products; processes; product flow, functional design, spare requirements, equipment, labour efficiency and costs. Human engineering and appropriate environmental requirements for the worker - lighting, ventilation, temperature and humidity. Time and motion studies.

Lecture - 20 hrs.
Practical - 30 hrs.
Y2-T3

ENG. 140A - TRACTOR DRIVING I

Maintenance of tractors and their operation with and without associated implements. Emphasis on daily, weekly servicing and off-season servicing.

ENG. 140B - TRACTOR DRIVING II

Tractor operation - hill-starting, tow-starting. Introduction to tractor hydraulics, care and repair of tyres. Traffic code and road signs.

ENG. 141A - FARM MACHINERY PRACTICE I

Disassembly of farm machine: use of specialised tools, checking of worn parts and surfaces, repair and/or replacement of worn parts (welding etc.). Panel-beating of bent parts; body filling and filling and of the low spots on the body.

Lecture - 20 hrs.

Practical - 20 hrs.

Y2-T2

ENG. 141B - FARM MACHINERY PRACTICE II

Rust and paint removal on the body of the disassembled machine, cleaning and sanding. Painting: paint selection, mixing (thinner and paint), undercoat and overcoat application - both brush and spray painting. Reassembly of the painted machine.

Lecture - 20 hrs.

Practical - 20 hrs.

Y2-T3

ENG. 142 - FARM POWER I

Alternate sources of power: animal, wind, water, solar energy, biogas, electrical, steam and internal combustion engines (petrol and diesel). Application of the various types of power in agriculture.

Lecture - 20 hrs.

Practical - 20 hrs.

Y1-T3

ENG. 143 - FARM POWER II

Fundamental principles and operation of internal combustion engines (diesel and petrol), design and construction, operation and maintenance of valve systems, bearings, rings, fuel delivery and metering, ignition systems, electrical, system, air cleaner and lubrication systems.

Lecture - 20 hrs.

Practical - 40 hrs.

Y2-T1

ENG. 144 - FARM POWER III

Disassembly and assembly, adjustments of systems and power trains: gear box and final drives, brakes, steering mechanisms, chassis, suspension, clutch and hydraulic systems, the use specialised shop tools and equipment for specific operations.

Lecture - 20 hrs.
Practical - 40 hrs
Y2-T3

ENG. 145 - FARM POWER IV

Troubleshooting: electrical systems, fuel systems, hydraulic systems and power trains. Use of gauges and devices to aid in adjustment of various systems. Power measurement by the use of dynamometer.

Lecture/Practical 0/30
Y3-T1

ENG. 146 - FARM MACHINERY II

General theoretical and practical course on weed control (cultivation): mechanical flame and chemical methods. Disease and pest control. Spraying: types of sprayers, chemical formulation and spraying; high volume spraying and low volume spraying. Aerial spraying. Fertiliser distributors and manure spreaders; use of slurry and methods of application.

Lecture - 20 hrs
Practical - 30 hrs.
Y3-T1

ENG. 147 - FARM MACHINERY III

Practical introduction to harvesting machinery for forage, grain, fruit, vegetable and root crops. Processing of these crops: cleaning, grading, grinding and canning. Light bush clearing equipment. Emphasis on capabilities, adjustment, operation and maintenance.

Lecture - 20 hrs.
Practical - 30 hrs.
Y2-T2

ENG. 150 - FLUID MECHANICS I

A course in fluid hydrostatics, hydrodynamics, fluid viscosity and turbulence, flow in closed conduits, open channel flow and flow around submerged objects.

Lecture - 20 hrs.
Practical - 20 hrs.
Y1-T3

ENG. 151 - FLUID MECHANICS II

Fluid flow measurement: velocity, pressure. Hydraulic machinery: turbomachinery theory, impulse turbine, propellers and windmills, fluid couplings and torque converters.

Lecture - 20 hrs.
Practical - 20 hrs.
Y2-T2

ENG. 152 - SOIL AND WATER MANAGEMENT I

Covers hydrology, water and wind erosion; erosion control structures terraces, ditches etc. Farm ponds, water spreading and water harvesting. Emphasis will be laid on practical experience.

Lecture - 20 hrs.
Practical - 30 hrs.
Y1-T1

ENG. 153 - SOIL AND WATER MANAGEMENT II

General knowledge in geology and the technical problems of water supply: sources of water, water development, pumping, conveyance and piping, storage, water treatment and distribution. Soil-water-plant relationships, general requirement for irrigation.

ENG. 154 - SOIL AND WATER MANAGEMENT III

Principles of overhead (sprinkler) irrigation, application rates, irrigation frequency and design of irrigation system. Drip irrigation as an alternative method.

Lecture - 20 hrs.
Practical - 30 hrs.
Y2-T1

ENG. 155 - SOIL AND WATER MANAGEMENT IV

Covers principles and practices of surface irrigation (furrow and flood irrigation) including site selection, land levelling, design, water conveyance and surface irrigation structures.

ENG. 160 - STRENGTH OF MATERIALS

The study of mechanical properties of materials and built-up sections. Tensile, compressive, shear and bending stresses in beams and columns under various types of loading. Shear and bearing failure in rivets and welds. Design and testing of various structural members constructed of concrete, steel, timber and other materials.

Lecture - 30 hrs.
Practical - 20 hrs.
Y2-T3

ENG. 161 - CONCRETE STRUCTURES

Ingredients used in concrete: cement, sand, aggregate and water. Proportioning, mixing and pouring of concrete. Reinforced concrete. Design and construction of selected concrete structures: foundations, walls, drainage and water storage structures.

Lecture - 20 hrs.
Practical - 30 hrs.
Y2-T3

ENG. 170 - STUDENTS PROJECTS

Design of an engineering project requiring knowledge and skills acquired in previous courses. The project report to include literature review, design calculations, drawings, construction details and test results.

Lecture - 10 hrs.
Practical - 40 hrs.
Y3-T2

ENG. 171 - OUTSIDE VISITS

Visits to various farming centres and industrial organisations to expose the students to various field applications of their engineering knowledge and skills. Students to write a report after the visit.

Visit - 40 hrs.
Y3-T3

ENG. 172 - SEMINARS AND GOVERNMENT PROCEDURE

Discussions of various agricultural engineering problems and Government procedures and policies with Guest Speakers: environment, family welfare, fiscal and monetary policy, unemployment problems, tax and government expenditure.

Y3-T3

FIELD ATTACHMENT

In order to strengthen the practical skills acquired during the course work, the students will be attached to various Government Stations/Establishments during the long vacations at the end of first and second years. The students will work under the officers in the station and will be expected to write a report based on the work they have done and observations they have made during the 2 months attachment.

KENYATTA COLLEGE OF AGRICULTURE AND ENGINEERING
DIPLOMA IN AGRO-MECHANICAL ENGINEERING
LIST OF EQUIPMENT.

A. FARM POWER.

1. Wheel balancing machine (static & dynamic)
2. Battery charger
3. Valve refacing machine
4. Power grinders
5. Bench vices
6. Spark plugs cleaners
7. air compressor and accessories
8. Hydraulic crane
9. Hydraulic jack
10. Condenser coil tester
11. Generator armature tester
12. Combustion tester
13. Dwell angle tester
14. Ignition tester
15. Timing light
16. Exhaust analyser
17. Engine Oscilloscope
18. Diesel and petrol engine compression testers
19. Vacuum ganges
20. Ridge reamers
21. Cylinder hones
22. Valve spring compressors
23. Feeler ganges
24. Plug gap setting tool
25. Plug spanners
26. Torque wrenches
27. Pick-up magnet
28. Inspection mirrow
29. Hydrometer
30. Battery cell tester
31. Valve key
32. Battery terminal cleaner

33. Carbon scraper
34. Cottor pliers
35. Piston ring expanding tool
36. Piston ring groove cleanliness
37. Spring tension testes
38. Stud removers
39. Valve grinding sticks and pastes
40. Bearing grease packet
41. Engine stethoscope
42. Adjustable spanners
43. Vice grip spanners
44. Chisels.
45. Set of drift punches
46. Set of star screw drivers
47. Set of screw drivers (blade)
48. circlip pliers
49. Long nosed pliers
50. Ball pein hammer
51. Plastic hammer
52. Set of A.F. and socket spanners including ratchet, flexible handle, extension bars, universal joint, speed handle.
53. Socket screw driver.
54. Set of Ring spanners (Metric, A.F. and whitworth)
55. Set of open-end spanners (Metric, A.F. and whitworth)
56. Set of Allen Keys.

B. FARM MACHINERY:

I. Primary and secondary Tillage.

1. Mouldboard plough - one-way and reversible.
2. Disk plough - one-way and reversible.
3. Chisel plough
4. Subsoiler
5. Rotary tiller
6. Ridger
7. Disk harrow - offset and tandem
8. Spike tine harrow
9. Spike tooth harrow
10. Landmaster.

II. Planting Equipment

1. Grain drill (John Deere); single disk 15 openers.
2. Row crop planter; 2 row with fertilizer units.
3. Potato planter

III. Cultivation and spraying Equipment

1. Tripple K
2. Rotoridger
3. Boom sprayer (Handi)
4. Boomless sprayer
5. Knapsach sprayer

IV. Harvesting Equipment - Root crop, Grain, forliage.

1. Resprocating mower - rear mounted
2. Frail mower
3. Gyro mo
4. Crimper
5. Finger wheel rake
6. Hay baler
7. Forage harvester.
8. Combine harvester
9. Potato harvester

V. Excavation and lighting.

1. Front-end loader
2. Backrake
3. Terracer blade
4. Post hole digger (auger type)

VI. Tractors and Other

1. 35 HP range tractors
2. 60 - 70 HP range tractors
3. 90 - 140 HP range tractors
4. Trailers - one self unloading
5. Fertiliser distributor (VICON)
6. Manure spreader.

C. DRAWING OFFICE

1. Drawing board (complete) (architectural)	4
2. Single drawing boards	100
3. T. square	100
4. Scale rule (metric)	100
5. set square 30° x 60°	100
6. set square 45° x 90°	100
7. Sliding set square (scaled)	100
8. Instruments case (drawing set)	100
9. Protractor (Full circle half circle)	100
10. Technical pens (for ink tracing complete)	100
11. Erasing shield	100
12. French curves (various shapes)	100
13. Lettering instruments	100
14. Lettering guide (various sizes)	100
15. Leroy pens set	100
16. Pen cleaner	100
17. Pencil sharpener	10
18. Dusting brush	100
19. Ink-bottle holder	100

20.	Erasing machine	10
21.	Ellipses template	100
22.	Tooling template	100
23.	Drafting template	100
24.	Electrical symbol template	100
25.	Pencil lead holders	100
26.	Drawing leads (set)	100
27.	Fibre-tip pens (set)	100
28.	Furniture template (architectural)	100
29.	Circles template	100
30.	Modeling blocks (all shapes)	10
31.	Drafting table lamp (fluorescent type)	4
32.	Metal cabinet (5 shelves)	5
33.	Adjustable curve	4
34.	Coloured pencil (set)	100.
35.	Blue line duplicating machine	2
36.	Zerowing machine	2
37.	Stencil duplicator	2
38.	Stencil board (complete)	4

EQUIPMENT LIST

D. PHYSICS

1. Tension Couple (Ridg. Mod.) Apparatus
2. Thermal Exp. Comparison Apparatus
3. Spring Constant Apparatus
4. Scarle's Apparatus for Young's Mod.
5. Apparatus For Coefficient of Rigidity
6. Aneroid Barometer
7. Compound Pendulum - Steel
8. Compound Pendulum - Wooden
Cylindrical Glasses
9. Demonstration Set For Pressure
10. Demonstration Set of Pulleys
11. Electroscopes
12. Conical Flasks
13. Standard Cells
14. Ammeters 2.5 amps
15. Boyle's Law Apparatus
16. Charles " " Fall Tube
17. Friction Cone J. Appartus
Lee's Disc Apparatus
Convection Tube
18. Hope's Apparatus
Fly Wheel
19. Force Table
20. Gas Burners (Cartridge)
21. Galvanometer
22. Filter Pump with Jet
23. Guarded Wheat Stone Bridge
24. Weight Hangers
25. Hamber Hemisphere
26. Hydrometer
27. Lenses Double Convex
28. Magnet Bars in Pairs
29. Magnets U
30. Magnetic Needles

31. Fortins Barometer
32. Boilers
33. Beakers
34. Calorimeters
35. Clamp Holders Steel
36. Clamp Holders (Wooden)
37. Manometers
38. Micrometer
39. Optical Bench with Clamps
40. Physical Balance
41. Photo Electric Tube
42. Photo Current Equipment
43. Prisms
44. Potensio meter
45. Resistances
46. Voltmeter 20V
47. Weight Box
48. Vacuum Pump
49. Centrifugal Apparatus
50. Scarles Apparatus For Linear Expansion
51. Conduction Apparatus
52. Rule 1/2 meter
53. Rule 1 meter
54. Spectrometer
55. Tuning Forks
56. Vernier Calliper
57. Viscosity meter

E. VISUAL AIDS

1. Slide Projector
2. Hovie Projector
3. Overhead Projector
4. Screen
5. Strip Projector
6. Slide Magazines.

F. SURVEYING EQUIPMENT

1. Plane Table and Tripod
2. Telescopic Alidate
3. Transit with Tripod
4. Plumb-bob
5. Theodolite w/tripod
6. Abney Level
7. Compass
8. Spirit Level
9. 100 meter steel tape
10. Dumpy Level
11. Leveling rod w/bag
12. 100 ft. Engineers Chain
13. Set of Chaining Pins
14. Clinometer
15. Quick-set Level w/tripod
16. Hand Level
17. Chain Tensionmeter
18. 90° Prism Offsetters
19. 90° Mirrow Offsetters
20. 30 meter Chain
21. Parallax bar
22. Stereoscope
23. Planimeter
24. Subtence bar w/tripod
25. Ranging
26. Wooden mallets.

G. WORKSHOP

I. WOODWORK

1. Power wood planer
2. Balde saw
3. Radial saw
4. Trable saw
5. Power drill
6. Wood lathe and tools

7. Jointer
8. Disc Sander
9. Denches (Wooden)
10. Bench vices
11. Fire extinguisher
12. Cross cut saw
13. Chisels (set of various sizes)
14. Marking gauges
15. Rules (steel) - 1 meter, 2 meter
16. Pull-push tape
17. Brace and bit
18. Wood Planes
19. Claw hammers
20. Tennon saw
21. Try squares

II. Welding, Casting and Forging

1. Anvil
2. Metal-covered benches
3. Bench vices
4. Forges-filled with chimney
5. Pedestal Grinder
6. Welding machines (AC/DC current)
7. Welding tables
8. Cabinets for electrodes, welding rods and tools -
spanner, lighter etc.
9. Welding shields
10. Gloves
11. Welding goggles
12. Oxyacetylene cylinder with accessories
13. Cylinder carrier
14. Tongs
15. Spot welder
16. Portable welding generator (engine operated)
17. Fire Extinguisher
18. Swange block
19. Sand casting equipment (foundry tools)

20. Soldering coppers
21. Blow lamps
22. Electric soldering tuns w/thermostat
23. Thermolyn Furnace (heat treatment)
24. Gloves

III. Metal Workshop

1. Agle iron cutter
2. Lathe machine and associated tools
3. Drill press - variable speed
4. Sheet meter lever shear
5. Metal power cutting band saw
6. Pipe bender
7. Rockwell hardness tester
8. Hydraulic Press
9. Bench Grinder
10. Power hacksaw
11. Milling machine and associated tools
12. Shaping machine and associated tools
13. Saw sharpening equipment
14. Wooden metal for sheet metal stakes
15. Sheet metal bender
16. Anvil
17. Other tools to be obtained from the Toolstore
19. Tin strips

H. CONCRETE

1. Engine concrete mixer
2. Electric concrete mixer
3. Wheelburrow
4. Spades and shovels
5. Trowels
6. Builders square
7. Builders hammer
8. Builders level
9. Plumb bob

10. Measuring tapes (metric)
11. Builders chisels
12. Ladders (aluminium)
13. Builders telescopic level
14. Tensile/compression tester
15. Float (wooden and metal)
16. Concrete drill

I. SOIL AND WATER MANAGEMENT

1. Pumps - centrifugal, reciprocating, propeller, turbine, hydraulic ram, gear, diaphragm, vane, submersible, deep well.
2. Borehole equipment - to study drawdown, yield, etc.
3. Hydraulic bench
4. R.P.M. gauge
5. Velocity measuring equipment (gauges)
6. Venturi meter; orifice meters
7. Manometers
8. Inclination flow channel
9. Weir - constructed to specifications
10. Soil testing equipment including pH meters
11. Moisture meters (soil)
12. Portable irrigation pumps
13. Overhead irrigation pipes (aluminium) - mains, laterals, risers, sprinklers
14. Water storage and treatment station
15. Terracing blade
16. Bulldozer - dam construction
17. Scaper - dam construction
18. Trench excavator
19. Soil augers
20. Float level gauges

J. PROCESSING LAB

1. Batch and continuous driers
2. Bag drier
3. Grain handling equipment - auger, cup elevators
4. Weighing machines (Avery)
5. Spring balances
6. Air tunnel with fan for blowing air
7. Wet-dry bulb thermometer
8. Thermocouple equipment and recorder
9. Max-min thermometer
10. Sling sychrometer
11. Moisture tester for grunular material
12. Bi-metal thermometer
13. Hammer mill w/screens
14. Maize sheller
15. Grain cleaner w/screens
16. Sieve shaker (motor)
17. Electric cooker
18. Refrigerator
19. Coffee puper
20. Inclined manometer
21. Pilot tube
22. Humidity meters
23. Grain grading machine - sieve
24. Potato/fruit grading machine - sieve, belt
25. Model canning factory
26. Model dehydrating plant
27. Pressure gauges
28. Food testing equipment

K. TOOLSTORE

1. Allen Keys - Imperial and Metric Sets.
2. Threading Equipment - Dies, die stock, taps (withworth, fractional and metric), thread gauges, thread files.
3. Vernier calipers (Imperial and metric)
4. Depth gauge, Height gauge, Surface gauge

5. Micrometer
6. Chisels - cold, diamond, halfround, cape
7. Centre punch
8. Centre drill - sets
9. Tube cutter
10. Twist drills - taper shank, straight shank
11. Counter sink drills
12. Drift punches
13. Dial Test Indicator
14. Electrical kits - screw drivers, wire strippers, knives, lineman's pliers, etc.
15. Files - round, flat, wade, triangle, square half round
16. Body file (bodywork)
17. G-clamps
18. Rivet guns
19. Reamers
20. Rulers
21. Paint brushes
22. Paint spray guns
23. Paint rollers
24. Pliers - vice grip, long nose, slip joint, fencing
25. Portable Electrical - grinder, hand drills
26. Adjustable spanners
27. Pipe spanners
28. Measuring tape
29. Hole punches
30. Hacksaws
31. Hand vice
32. Hammers - ball pein, claw, sheet metal, sledge, plastic, backsmith
33. Tachometer
34. Grease guns
35. Flarring tool
36. Tin ships
37. Wire brushes
38. Seribers
39. Socket spanners, - ratchets, flexible handles, extension shafts, universal joints, speed handles.

40. Ring spanners (Imperial, metric, fractional)
41. Monkey spanners
42. Adjustable spanner
43. Tap extractors
44. Squares - builders, combination, try,
45. Spoke shares
46. Screw drivers - sockets, star, blade (sets)
47. Auger bits
48. Post hole digger
49. Soil auger
50. 'Jembes' and spades
51. Picks
52. Axes, mattocks and hatchets
53. Masonary tools - brick chisels, clipping hammer, trowels, floats, stone chisels, wheel barrows, masonary drills, plumb bob.
54. Nail pullers
55. Claw baw
56. Planes - jack, smoothing, block, framing
57. Putty knives
58. Draw knives
59. Pasps - smooth, medium, coarse
60. Saws - back, coping, ripping, cross-cut, pruning, miter, key hole; saw sharpening equipment.
61. Feeler gauges
62. Heli coil tools
63. Besides the tools, there should be consumable stocks - e.g. nuts and bolts; rivets, washers nails, stapples. paint and thinner, wood - timber and posts, cement, stone, concrete blocks, body filler (panel beating).
Electrical accessories and wires. Tyre patches, and tubes.
Greases, oils, oil filter, fuel filters, sheet metal welding rods and electrodes. Steel - round bars, angle irons, channel irons, flat plates, pipes. Fencing wire.

These consumable stocks may be stored either in the tool store or in a separate store. As some of the stores are inflammable, safety should be adhered to very strickly.