Sokoine University of Agriculture
Faculty of Agriculture
Department of Agricultural Engineering and Land Planning

B.Sc. AGRICULTURAL ENGINEERING DEGREE PROGRAMME (B.Sc. AE)

PROGRAMME AIMS

The B.Sc. Agricultural Engineering degree programme aims to provide:

i. The necessary background in technology, analytical and managerial skills which will enable graduates to analyse and assess engineering systems for effective application to agriculture.
ii. Professionalism that permits graduates to fill responsible professional positions that demand both engineering and agricultural related skills.
iii. Knowledge and skills in the design, construction, operation, management and maintenance of water supply systems including rain water harvesting for agricultural production.
iv. Knowledge and skills to enable graduates to design and construct simple renewable energy sources for agricultural production as well as for domestic purposes.
v. Basic engineering principles to enable graduates plan, design and manage agricultural mechanization programmes.
vi. The necessary entrepreneurial skills required for graduates to become job creators rather than job seekers.
vii. A sound base from which the graduates can embark on postgraduate studies in bio-systems engineering and related professional disciplines.

To produce graduates that:

viii. Can spearhead the move to modernize agriculture.
ix. Have more focussed agricultural engineering knowledge and skills to fill in gaps often encountered in agricultural industries.
x. Are competent in the technology and art of processing of agricultural products. with the eventual aim of adding value to satisfy market demands.

Are well versed with the techniques and aspects of land use planning.

COURSE STRUCTURE

Semester 1

COURSE ANTE	COURSE TITLE	CONTACT HOURS			CREDITS
		Lect	Sem	Prac	
	CORE COURSES				
MTH 104	General Mathematics I	45	30	0	2
AE 110	Workshop Training	0	0	120	2
AE 111	Engineering Drawing	15	0	90	2
AE 112	Engineering Statics	45	0	30	2
AS 101	Introduction to Animal Production	20	0	20	1
CIT 100	Computer Applications	30	0	90	2.5
Total		**155**	**30**	**350**	**11.5**
	ELECTIVE COURSES				
FT 104	Food microbiology I	20	0	20	1
AE 113	Introduction to Agricultural Engineering	15	30	0	1
SC 100	Communication Skills I	45	30	0	0
DS 100	Principles, theories, and contemporary issues in Development	45	30	0	2
ENV 111	Introduction to Meteorology	20	0	20	1
Total		**145**	**90**	**40**	**5**
Total Semester 1					**16.5**

Semester 2

COURSE ANTE	COURSE TITLE	CONTACT HOURS			CREDITS
		Lect	Sem	Prac	
	CORE COURSES				
MTH 106	Introductory Statistics	45	30	0	2
MTH 107	General Mathematics II	45	30	0	2
AE 110	Workshop training	0	0	120	2
AE 114	Fundamentals of Electrical Engineering	45	0	30	2
AE 115	Engineering Dynamics	45	0	30	2
SC 101	Communication Skills II	45	30	0	2
Total		**225**	**90**	**180**	**12**
	ELECTIVE COURSES				
AE 116	Computer Applications for Agricultural Engineers	15	0	30	1
AS 103	Introduction to anatomy and physiology of farm animals	45	0	30	2
EE 105	Principles of Administration and Management	20	20	0	1
Total		**80**	**20**	**60**	**4**
Total Semester 2					**16**
Total Semester 1 & 2					**32.5**

Semester 3

COURSE ANTE	COURSE TITLE	CONTACT HOURS Lect	Sem	Prac	CREDITS
	CORE COURSES				
MTH 201	Biometry	45	30	0	2
AE 210	Introduction to Engineering Design	20	0	20	1
AE 211	Strength of Materials	45	0	30	2
AE 213	Thermodynamics	45	0	30	2
EE 202	Extension Methods	30	60	0	2
Total		**185**	**90**	**80**	**9**
	ELECTIVE COURSES				
SS 201	Fundamentals of Soil Science	45	0	30	2
AE 214	Introduction to Electronics for Agricultural Engineers	15	0	30	1
AEA 101	Introductory Agricultural Economics	30	10	20	1.5
RD 207	Rural Industrialization	30	0	0	1
SC 100	Communication Skills I	45	30	0	0
MTH 202	Numerical Methods II	45	30	0	2
AEA 104	Introduction to micro and macro economics	30	30	0	1.5
Total		**240**	**100**	**80**	**9**
Total Semester 3					**18**

Semester 4

COURSE ANTE	COURSE TITLE	CONTACT HOURS Lect	Sem	Prac	CREDITS
	CORE COURSES				
MTH 108	Numerical Methods I	45	30	0	2
AE 212	Surveying	30	0	60	2
AE 215	Farm Power and Mechanization	15	0	30	1
AE 217	Materials Technology for Agricultural Engineers	30	0	60	2
AE 218	Fluid Mechanics	30	0	60	2
AE 219	Basics of Computer Programming	30	0	60	2
CS 204	Principles of Agronomy	30	0	30	1.5
Total		**210**	**30**	**300**	**12.5**
	ELECTIVE COURSES				
AEA 102	Introduction to Agribusiness	30	15	15	1.5
ENV 306	Environmental Impact Assessment	45	30	0	2
Total		**75**	**45**	**15**	**3.5**
Total Semester 4					**16**
Total Semester 3 & 4					**34**

Semester 5

COURSE ANTE	COURSE TITLE	CONTACT HOURS			CREDITS
		Lect	Sem	Prac	
	CORE COURSES				
AE 310	Instrumentation and Measurements	30	0	60	2
AE 311	Analysis and Design of Farm Structures	45	0	30	2
AE 312	Principles of Hydrology	15	0	30	1
IWRE 317	Design of Irrigation Systems	30	0	60	2
AE 314	Engineering Properties of Biological Materials	30	0	60	2
AE 315	Agricultural Machinery Design	30	0	60	2
Total		**180**	**0**	**300**	**11**
	ELECTIVE COURSES				
IWRE 312	Water Supply	15	0	30	1
AE 316	Microcomputer Systems	15	0	30	1
IWRE 321	Rainwater Harvesting	15	0	30	1
AE 318	Introduction to Power Electronics	15	0	30	1
SC 100	Communication Skills I	45	30	0	0
Total		**105**	**30**	**120**	**4**
Total Semester 5					**15**

Semester 6

COURSE ANTE	COURSE TITLE	CONTACT HOURS			CREDITS
		Lect	Sem	Prac	
	CORE COURSES				
AE 300	Research Methods and Research Project I	30	10	50	2
AE 320	Mechanical Processing of Agricultural Produce	30	0	60	2
IWRE 318	Soil Mechanics and Foundation Engineering	30	0	60	2
AE 322	Electrical Power Systems and Machines	45	0	30	2
AE 323	Agricultural Machinery and Equipment	15	0	30	1
AE 324	Renewable Energy Resources and Technologies	45	0	30	2
Total		**195**	**10**	**260**	**11**
	ELECTIVE COURSES				
AE 325	Drainage and Land Reclamation	15	0	30	1
AE 326	Computer Aided Design	15	0	30	1
AE 327	Industrial Crop Processing	15	0	30	1
AE 328	Communications and Computer Networking	15	0	30	1
AE 330	Aspects of Environmental Engineering	30	0	0	1
Total		**90**	**0**	**120**	**5**
Total Semester 5					**16**
Total Semester 5 & 6					**31**

Semester 7

COURSE ANTE	COURSE TITLE	CONTACT HOURS Lect	Sem	Prac	CREDITS
	CORE COURSES				
AE 400	Research Project II	0	10	110	2
AE 410	Mechanics of the Tractor and Implements	45	0	30	2
IWRE 410	Irrigation Structures	30	0	60	2
AE 412	Grain Storage, Packaging and Transport	45	0	30	2
AE 413	Engineering Operations Management	30	0	0	1
AE 426	Waste Management	45	0	30	2
Total		**195**	**10**	**260**	**11**
	ELECTIVE COURSES				
AE 414	Introduction to Remote Sensing and GIS	45	0	30	2
AE 415	Controlled Environment Production Systems	30	0	0	1
* RD 308	Designing Rural Development Programmes/Projects	20	20	0	1
AE 416	Process and Plant Design	15	0	30	1
AE 417	Fluid Power Systems	15	0	30	1
AE 418	Sensors and Controls for Precision Agriculture	15	0	30	1
SC 100	Communication Skills I	45	30	0	0
Total		**165**	**30**	**120**	**6**
Total semester 7					**17**

Semester 8

COURSE ANTE	COURSE TITLE	CONTACT HOURS Lect	Sem	Prac	CREDITS
	CORE COURSES				
AE 400	Research Project III	0	10	50	1
AE 419	Agricultural Machinery Management	15	0	30	1
AE 420	Farmstead Planning and Construction of Farm Structures	45	0	30	2
AE 421	Ergonomics, Safety and Maintenance	45	0	30	2
AE 422	Aspects of Financial and Human Resource Management	20	20	0	1
AE 423	Thermal Processing of Biological Materials	45	0	30	2
AE 428	Irrigation Water Management	20	0	20	1
Total		**190**	**30**	**190**	**10**
	ELECTIVE COURSES				
AE 424	Design of Detention Reservoirs and Small Dams	45	0	30	2
AE 425	Mathematical Planning Techniques	15	0	30	1
AE 427	Perishable Crop Storage and Processing	15	0	30	1
AEA 210	Agribusiness and Entrepreneurship Development	30	30	30	2
RD 309	Appraisal, Monitoring and Evaluation of Rural Development Programmes/Projects	45	30	0	2
Total		**150**	**60**	**120**	**8**
Total Semester 8					**18**
Total Semester 7 & 8					**35**

PRACTICAL TRAINING

LEVEL OF PRACTICAL TRAINING	DURATION (Weeks)	TIMING	ACTIVITIES TO BE UNDERTAKEN
PT 1	8	After the 2nd semester	Craftsman level
PT 2	8	After the 4th semester	Technician level
PT 3	8	After the 6th semester	Engineer's level

PRINCIPAL LEARNING OUTCOMES

A Knowledge and Understanding

A successful student will have gained and be able to demonstrate knowledge and understanding of:

A1 The essential facts, concepts, theories and principles of Agricultural Engineering, and its underpinning science and mathematics.

A2 The wider multidisciplinary engineering context and its underlying principles.

A3 The impact of engineering solutions in a global, economic, environmental, commercial, and societal context

A4 The appropriate agricultural, and/or biological sciences, and/or natural resource topics. This includes fields such as biological materials, computer and automatic control systems, information systems, machine systems, modified environment design, natural resource systems, processing systems, and structural design.

A5 The professional and ethical responsibility.

A6 Contemporary issues.

Teaching Strategy
Lectures are the main way of imparting knowledge and understanding (A1-A6) but seminars and small group tutorials are also used: seminars and tutorials are led by staff and/or students. Applying computer software packages is also used.

Learning Strategy
Students are encouraged to contribute to their own learning experience by independent reading. They are provided with references to books, scientific papers and other learning materials to enhance their understanding of specific subject areas. Group work exercises encourage a collective approach and responsibility for gathering knowledge and the sharing of understanding.

Assessment strategy
Primarily assessed by closed-book, written examinations supported by a variety of different forms of coursework that includes essays, projects, case studies and other exercises. Most courses include coursework, thus ensuring an element of formative as well as summative assessment. Seminar, tutorial and poster presentation exercises assess knowledge and understanding that is demonstrated verbally. The final research project report in the fourth year (which is not directly supported by lectures or seminars) assess students' abilities to independently acquire knowledge and understanding.

B Practical skills

A successful student will be able to:

B1 Conduct laboratory and field experiments, as well as analyze and interpret data.

B2 Prepare and present research reports.

B3 Communicate with professionals and non-professionals involved in the industry.

B4 Develop and use specific computer software in design, analysis, and control.

Teaching Strategy
Professional/practical skills relevant to agricultural engineering applications are demonstrated in specific lectures, seminars, laboratories, computing sessions, workshops, field visits, practical training in industry, individual and group project work, design work, (B1-B4).

Learning Strategy
Students acquire skills (B1-B5) through a 'hands-on' approach in the most applied modules, e.g. Workshop Training; Engineering Drawing.

Assessment strategy
The methods outlined in A also test the development of practical skills (B1-B4). Case-studies and report writing and presentation are the major methods of assessment.

C Cognitive/Intellectual Skills

A successful student will be able to:

C1 Apply knowledge of mathematics, science and engineering to the analysis of problems.

C2 Design and conduct experiments, as well as to analyze and interpret data.

C3 Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

C4 Demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs.

C5 Comprehend the broad picture and thus work with an appropriate level of detail.

C6 Use the techniques, skills and modern engineering tools necessary for engineering practice.

Teaching Strategy
Seminars provide the main opportunity for students to evaluate evidence and formulate objective and coherent arguments (C1-C4). Problem solving skills are developed in tandem with the range of activities described above that are designed to develop their practical skills.

Learning Strategy
Students learn through problem-solving, handling data and discussion. Students are encouraged to justify their opinions in discussion and in their final research project report where they practice production of reasoned arguments and analysis.

Assessment strategy
The range of methods described in both A and B also provides an opportunity to assess cognitive skills (C1-C6), e.g., in the form of seminars. The final research project report is a major vehicle for the

assessment of all the cognitive skills (C1-C6).

D Key/transferable skills

A successful student will be able to:

D1 identify, formulate and solve engineering problems

D2 communicate effectively

D3 function on interdisciplinary teams

D4 effectively use general information technology (IT) facilities and information retrieval skills.

D5 plan self-learning and improve performance as the foundation for lifelong learning/ continuing professional development (CPD).

Teaching Strategy
The use of PCs and data analysis (D4) features throughout the duration of the degree programme. As well as contributing directly to key skills, they also contribute to the other learning outcomes A, B and C. Oral communication and presentational skills (D2) are practised, particularly in seminars and tutorials. Several modules involve teamwork (D3). All modules involve independent, student-centred work requiring completion by specific deadlines (D5).

Learning Strategy
Students learn through the production of reports. Emphasis is placed on time management throughout the programme.

Assessment strategy
The strategy and methods used to assess learning outcomes A, B and C provide an integrated approach to the development of key skills D1-D5 from a broad base. The final research project report is also a major vehicle for the assessment of key skills (D1-D5).

ATTRIBUTES OF THE GRADUATES

As a result, graduates of the Agricultural Engineering degree programme should be able to work in one or a combination of the following areas:

- Large scale irrigation projects
- Mechanized farms
- Food processing industries
- Design and manufacturing firms for agricultural machines and implements
- Small scale industries for the production of energy saving systems
- Controlled environment production systems
- Land use management and environmental protection
- NGOs, CBO's
- Institutions of higher learning
- Self employment

DURATION OF THE DEGREE PROGRAMME

In accordance with the Semester guidelines and standards, the duration of the degree programme in Agricultural Engineering shall be eight Semesters for full time students and up to 16 Semesters for part time students.

ADMISSION REQUIREMENTS

In addition to the minimum admission requirements for first degree courses at SUA, applicants to the degree programme in Agricultural Engineering and management must:

a) 'A' level candidates (Direct Entrants)

Possess Principal level passes in Advanced Level Mathematics and Physics/Chemistry/Geography AND at least a credit pass in Physics and Chemistry/Biology/ Science and Practice in Agriculture in the Ordinary Level Certificate of Secondary Education Examination or an Equivalent Examination

The sum of the points from the principal level passes should not be less than 4.0.

b) Mature Entrants

Possess Full Technicians Certificate (FTC) or equivalent qualifications with an average grade of C and at least a **"C"** grade in Mathematics.

Possess a Diploma in Agricultural Engineering or related field having passed with at least a credit and must have a credit pass in Mathematics in the Certificate of Secondary Education Examination.

SPECIAL EXAMINATION REGULATIONS

a) General Regulations

In addition to the general examination regulations, the following shall apply for B.Sc. Agricultural Engineering degree programme:

i. Students' performance shall be assessed continuously throughout the semester. Such continuous assessment shall include at least one test per each credit hour of a course in a semester and may also consist of Laboratory report, assignments, etc.

ii. The overall pass mark shall be 50% for all examinations.

iii. Each candidate shall be required to undertake a Special Project, whose report shall be completed and submitted for examination at least two weeks before the start of the final Semester examinations. Special Projects shall be conducted during the last three semesters. A candidate failing in the Special Project will not be allowed to graduate until he/she passes it.

iv. Each candidate shall be required to undertake Practical Training in industry (PT) during intersession and part of the long break at the end of the second, fourth and sixth semesters. Each Practical Training shall be assessed and will form part of the assessment of the succeeding Semester.

v. Where a candidate fails in Industrial Practical Training, guidelines for PT assessment shall apply.

vi. A candidate who fails in a course that is assessed by continuous assessment only viz. AE 110 shall be required to retake the failed course when it is next offered provided he/she does not fail in more than one third of the courses and his/her GPA is not less than 2.6.

vii. Courses that are offered by other Faculties and Institutes shall be governed by the regulations of the respective Faculty or Institute.

b) Course Work and end of Semester Assessments

i. Course work assessment for courses which do have laboratory practicals shall be done by giving students tests, essays, practicals and assignments and the assessment shall carry 60% of the final marks. The end of Semester examination shall comprise 40% of the marks.

ii. Course work assessment for courses which do not have laboratory practicals shall be done by giving students tests, essays, and assignments and the assessment shall carry 40% of the final marks. The end of Semester examination shall comprise 60% of the marks.

iii. Courses that do not involve formal lectures, viz. AE 110 shall be assessed by giving practical assignments that will comprise 100%.

c) Special Rules

(i) A student will be expected to have a course load of at least 13 credits for each of semesters one, three, and five. In semesters two, four, six, seven, and eight a student will be expected to have a course load of at least 12 credits in each semester. Of the minimum credits in the respective semesters two will be taken from electives.

(ii) In order to graduate a student should have accumulated a minimum of 99 credits.

d) Practical Training in Agricultural Industry

The Department of Agricultural Engineering and Land Planning shall be responsible for the organization and running of the Industrial Practical Training sessions at the end of the second, fourth and sixth Semesters during the intersession period and part of the long break. The duration of each Practical Training session shall be eight weeks. The Preparation and conduct of the training shall be done as follows:

A. Preparation of Practical Training

(i) The allocation of Industrial Practical Training places to students shall be undertaken by the Department of Agricultural Engineering and Land Planning. Training at a practical training place not approved and allocated by the Department before the start of training shall not be recognized.
(ii) Lists of Practical Training places shall be made available to students not later than five weeks before the end of the respective Semesters.
(iii) The allocation of Practical Training places to students shall be completed not later than one week before the end of the respective Semesters.

B. Guidelines for Practical Training Assessment

(i) Every Industrial Practical Training shall be treated as a subject of the succeeding Semester.
(ii) Non completion of Practical Training shall lead to failure.
(iii) Practical Training reports shall be handed in for assessment before the end of the second week of the succeeding Semester and marking completed before the end of that Semester.
(iv) Candidates may be required to present themselves before the examiners for an oral examination.
(v) A candidate who fails in a part of a Practical Training because of reasons other than (ii) or (iii) shall be allowed to carry it forward and retake the Practical Training in the particular part failed.

If the candidate fails again, he/she will be required to repeat the training when it is next offered before proceeding to the next one or before he/she can be allowed to graduate.

(vi) A candidate who fails in a Practical Training examination because of reasons mentioned in (ii) or (iii) shall be required to repeat the training when it is next offered before proceeding to the next one or before he/she can be allowed to graduate.

(vii) A candidate who fails after repeating a Practical Training twice shall be discontinued from studies.

(viii) Students who do not go to places allocated to them for Practical Training without satisfactory reasons shall be deemed to have absconded from PT and shall as a result, be discontinued from their studies.

WEIGHTING OF FINAL RESULTS

(a) All assessed courses in the first to the last Semester shall count towards the final results.

(b) The weighting of the examinations grade shall be as follows:

i) The total weight shall be 1.0

ii) The total weight factor of the three Industrial Practical Training sessions shall be 0.1

iii) The total weight factor for all the subjects including the Special Project shall be 0.9. The weight of each subject contributing to this weight factor shall be proportional to the number of credits for the respective course.

(c) The grading system shall be as follows:

A =70 – 100
B^{+}=65 – 69
B = 60 – 64
C = 50 – 59
D = 40 – 49
E = 0 – 39

(d) Classification of Degrees

The final degree classification shall be as follows:

Class	Grade	GPA range
First Class	A	4.4 – 5.0
Upper Second	B+	3.5 – 4.3
Lower Second	B	2.7 – 3.4
Pass	C	2.0 -2.6

Long Term Plans

The Department is expected to grow in terms of academic and research programmes in the proposed areas of study. This will cover training at the undergraduate and postgraduate levels and clientele short courses. Out of the expected strength it is also expected to conduct consultancy activities and advisory services in a wider engineering context. In totality the Department envisages to grow to a Faculty of Campus College. Thus there will be need to source for external funding to establish more infrastructure and acquire relevant and sufficient equipment