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

B.Sc. BIOPROCESS AND POST-HARVEST ENGINEERING DEGREE PROGRAMME (B.Sc. BPE)

PROGRAMME AIMS

The B.Sc. Bioprocess and Post-harvest Engineering degree programme aims to provide:

(i) The necessary background in technology, analytical and managerial skills which will enable graduates to analyse and assess bioprocess and post-harvest engineering systems.
(ii) Professionalism and confidence that permits graduates to fill professional positions that demand both engineering and materials related skills.
(iii) Knowledge and skills in design, construction, operation, management and maintenance of bioprocess and post-harvest systems infrastructure and equipment.
(iv) The necessary entrepreneurial skills required for graduates to become job creators rather than job seekers.
(v) A sound base from which the graduates can embark on postgraduate studies in bioprocess and post-harvest engineering and related professional disciplines.
(vi) Confidence required of graduates in communication to address broad community and professional issues in a multidisciplinary spectrum of operation.

To produce graduates that:

(vii) Can spearhead the move to reduce post-harvest losses and modernize the value chain.
(viii) Have broad knowledge and skills to fill gaps often encountered in processing industries and the related materials handling systems.
(ix) Are competent in the technology and art of processing and preservation of biological products with the eventual aim of adding value to satisfy market demands and bridge food insecurity.
(x) Can manage bioprocess and post-harvest systems organizations to perform at the expected levels.

COURSE STRUCTURE

SEMESTER I

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 I	15	0	90	2
AE 111	Engineering Drawing	15	0	90	2
AE 112	Engineering Statics	45	30	0	2
FT 102	Food Biochemistry	20	0	20	1
Total		**140**	**60**	**200**	**9**
	ELECTIVE COURSES				
DS 100	Theories, Principles and current issues in Development	45	30	0	2
FT 100	Introduction to Food Science	40	0	10	1.5
SC 100	Communication Skills I	45	30	0	0
EE 101`	Introductory Sociology	30	0	0	1
AEA101	Introductory Agricultural Economics	30	10	20	1.5
Total		**190**	**70**	**30**	**6.0**
Total Semester I		**330**	**130**	**230**	**15.0**

SEMESTER II

COURSE ANTE	COURSE TITLE	CONTACT HOURS			CREDITS
		Lect	Sem	Prac	
	CORE COURSES				
MTH 107	General Mathematics II	45	30	0	2
AE 110	Workshop Training II	15	0	90	2
AE 114	Fundamentals of Electrical Engineering	45	0	30	2
AE 115	Engineering Dynamics	45	30	0	2
SC 101	Communication Skills II	45	30	0	2
Total		**195**	**90**	**120**	**10**
	ELECTIVE COURSES				
AE 116	Computer Applications for Engineers	15	0	30	1.0
MTH 106	Introductory Statistics	45		30	2.0
AEA 105	Principles of Accounting	45	0	30	2.0
EE 105	Principles of Administration and Management	20	20	0	1.0
CIT 100	Introduction to Microcomputers	30	0	60	0
Total		**155**	**20**	**150**	**6.0**
Total Semester II		**350**	**110**	**270**	**16**
Total Semester (I + II)		**680**	**240**	**500**	**29.5**

SEMESTER III

COURSE ANTE	COURSE TITLE	CONTACT HOURS			CREDITS
		Lect	Sem	Prac	
	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
BPE 211	Engineering Thermodynamics	45	0	30	2
BPE 212	Introduction to Materials and Energy Balance	30	30	0	1.5
FT 104	Food Microbiology I	20	0	20	1
CIT200	Computing Applications	45	0	30	2
Total		**250**	**60**	**130**	**11.5**
	ELECTIVE COURSES				
EE 202	Extension Methods	30	60	0	2
RD 207	Rural Industrialisation	20	20	0	1
AEA 210	Agribusiness and Entrepreneurship development	30	30	30	2
AE 214	Introduction to Electronics	15	0	30	1
Total		**95**	**110**	**60**	**6**
Total Semester III		**345**	**170**	**190**	**17.5**

SEMESTER IV

COURSE ANTE	COURSE TITLE	CONTACT HOURS			CREDITS
		Lect	Sem	Prac	
	CORE COURSES				
MTH 108	Numerical Methods I	45	30	0	2
AE 217	Engineering Materials Technology	30	20	40	2
IWE 210	Fluid Mechanics	30	0	60	2
BPE 213	Fundamentals of Heat and Mass Transfer	20	0	20	1
AS 311	Processing and Preservation of Hides and Skins	20	0	20	1
AEA 102	Introductory Agribusiness	30	15	15	1.5
Total		**175**	**65**	**155**	**9.5**
	ELECTIVE COURSES				
AE 219	Basics of Computer Programming	30	0	60	2
AE 221	System Dynamics	30	15	15	1.5
RD 210	Computer Applications in Statistical Data Analysis	30	0	30	1.5
Total		**90**	**15**	**105**	**5**
Total Semester IV		**265**	**80**	**260**	**14.5**
Total Semester (III+IV)		**610**	**250**	**450**	**32.0**

SEMESTER V

COURSE ANTE	COURSE TITLE	CONTACT HOURS			CREDITS
		Lect	Sem	Prac	
	CORE COURSES				
BPE 311	Engineering Properties of Biological Materials	30	0	60	2
BPE 312	Systems Components Design and Selection	30	0	60	2
BPE 313	Instrumentation, Automation and Control	30	0	60	2
FT 204	Food Chemistry	48	20	24	2
IWE 314	Waste Treatment Systems Design and Management	30	0	30	1.5
Total		**168**	**20**	**234**	**9.5**
	ELECTIVE COURSES				
AE 316	Microcomputer Systems	15	0	30	1
AE 318	Introduction to Power Electronics	15	0	30	1
IWE 312	Water Supply	15	0	30	1
AE 221	System Dynamics	30	15	15	1.5
Total		**75**	**15**	**105**	**4.5**
Total Semester V		**243**	**35**	**339**	**14.0**

SEMESTER VI

COURSE ANTE	COURSE TITLE	CONTACT HOURS			CREDITS
		Lect	Sem	Prac	
	CORE COURSES				
AE 300	Research Methods and Research Project I	15	30	0	1
AE 322	Electrical Power Systems and Machines	45	0	30	2
BPE 314	Unit Operations I	30	30	30	2
BPE 315	Post-harvest Technologies of Industrial Crops	30	0	45	2
ENV 306	Environmental Impact Assessment	45	30	0	2
FT 208	Science and Technology of Meat and Fish	30	10	20	1.5
Total		**195**	**100**	**125**	**10.5**
	ELECTIVE COURSES				
FT 209	Sensory Evaluation of Foods and Product Development	30	10	20	1.5
AE 328	Communications and Computer Networking	15	0	30	1
AE 324	Renewable Energy Resources and Technologies	15	0	30	1
AE 326	Computer Aided Design	15	0	30	1
Total		**75**	**10**	**110**	**4.5**
Total Semester VI		**270**	**110**	**235**	**15.0**
Total Semester (V+VI)		**513**	**145**	**574**	**29.0**

SEMESTER VII

COURSE ANTE	COURSE TITLE	CONTACT HOURS			CREDITS
		Lect	Sem	Prac	
	CORE COURSES				
BPE 400	Research Project II	0	10	110	2
AE 413	Engineering Operations Management	20	20	0	1
BPE 411	Post-harvest Handling and Storage of Non-Perishable Commodities	45	0	30	2
BPE 414	Process Plant Design and Hygiene	15	60	0	1.5
AE 430	Engineering Professional Ethics, Law and Safety	15	30	0	1
FT 303	Food Quality Assurance and Legislation	30	10	20	1.5
FT 306	Technology of milk Products	20	5	15	1.5
Total		**145**	**135**	**175**	**10.5**
	ELECTIVE COURSES				
AE 417	Fluid Power Systems	15	0	30	1
AEA 305	Agribusiness Project Appraisal and Evaluation	30	30	30	2
AE 3234	Renewable Energy Resources and Technologies	45	0	30	2
Total		**90**	**30**	**90**	**5**
Total Semester VII		**235**	**165**	**265**	**15.5**

SEMESTER VIII

COURSE ANTE	COURSE TITLE	CONTACT HOURS			CREDITS
		Lect	Sem	Prac	
	CORE COURSES				
BPE 400	Research Project III	0	10	50	1
AE 421	Ergonomics, Safety and Maintenance	45	0	30	2
BPE 413	Post-harvest Handling and Preservation of Horticultural Produce	30	0	60	2
BPE 412	Unit Operations II	45	0	30	2
BPE 415	Packaging and Packaging Design	15	0	30	1
Total		**155**	**30**	**200**	**8**
	ELECTIVE COURSES				
AE 429	Mechatronics	30	30	30	2
AEA 306	Human Resource Management	50	20	0	2
AEA 311	Business Laws and Ethics	40	40	0	2
Total		**120**	**90**	**30**	**6**
Total Semester VIII		**275**	**120**	**230**	**14**
Total Semester (VII+VIII)		**510**	**285**	**495**	**29.5**

PRACTICAL TRAINING (PT)

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
PT 4	2	As a group in the last 2 weeks of the 8th semester	Engineer's level

PRINCIPAL LEARNING OUTCOMES

A Knowledge and Understanding

On successful completion of the degree programme, students should be able to demonstrate knowledge and understanding of:

A1 Essential facts, concepts, theories and principles of basic engineering, and its underpinning science and mathematics.

A2 Wider multidisciplinary engineering context and its underlying principles.

A3 Principles of energy and materials flows for analysis, monitoring and operation of bioprocess and post-harvest engineering systems.

A4 Impact of engineering solutions in a global, economic, environmental, commercial, and societal context.

A5 Bio-physical and biological properties and behavior of materials governing application of science in engineering.

A6 Principles of unit operations, unit processes, quality control and environment management in planning, designing and making operational product-systems using appropriate standards and procedures.

A7 Professional and ethical responsibilities.

A8 Contemporary issues

Teaching Strategy

A variety of teaching methods will be used, including small group teaching, supervised study, tutorial sessions, seminars, presentations, invited speakers and discussion groups, lectures, practical classes and demonstrations. One-on-one supervision of a literature review, a mini-project and a dissertation by a single tutor is designed to promote continuity in the learning experiences provided. Applying computer software packages is also used.

Learning Strategy

Learning methods will include oral and written presentations, peer assessment of oral presentations, problem-solving assignments and feedback and interactive computer assignments. Some of the exercises will be group-based and will be followed by presentation of the results of the analysis. Working in groups encourages a collective approach and responsibility for gathering knowledge and the sharing of understanding. Learners will be expected to be able to respond adequately to questions relating to the interpretation of the analysis. They will also be encouraged to contribute to their own learning experience by independent reading. They will be provided with Recommended Readings: books, scientific papers and other learning materials to enhance their understanding of specific subject areas.

Assessment strategy

Students shall be primarily assessed by 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 shall be used to assess the student. The final research project report in the fourth year (which is not directly supported by lectures or seminars) assesses students' abilities to independently acquire knowledge and understanding.

B Practical skills

A successful student should be able to:

B1 Appropriately conduct laboratory and field experiments

B2 Analyze and interpret data

B3 Prepare and present research reports.

B4 Communicate with professionals and non-professionals involved in the industry.

B5 Develop and use specific computer software in design, analysis, and control of bioprocess and

post-harvest systems.

B6 Manage Bioprocess and Post-harvest Engineering systems.

B7 Fabricate simple bioprocess and post-harvest systems

Teaching Strategy

Professional/practical skills relevant to Bioprocess and Post-harvest Engineering systems applications shall be demonstrated in specific lectures, seminars, laboratories, computing sessions, workshops, field visits, practical training in industry, individual and group project work, and design work (B1-B7).

Learning Strategy

Learners will acquire skills (B1-B7) through a 'hands-on' approach in practical modules, e.g. Workshop Training; Engineering Drawing and Practical Training in industry.

Assessment strategy

The methods outlined in section A also test the development of practical skills (B1-B7). Case-studies and report writing and presentation are the major methods of assessment. In addition, B7 is assessed by experienced professionals in the field.

C Intellectual/Cognitive Skills

A successful student shall be able to:

C1 Integrate knowledge of mathematics, science and engineering in the analysis of problems.

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

C3 Plan and design systems, components, processes or products to meet desired needs

C4 Comprehend the broad picture and thus work with an appropriate level of detail.

C5 Use techniques, skills and modern engineering tools

C7 Manipulate and/or preserve biomaterials for economic returns, leverage of food insecurity and enhancement of their value and availability in the desired consumer needs.

Teaching Strategy

In addition to strategies outlined in section A above, seminars shall provide the main opportunity for students to evaluate evidence and formulate objective and coherent arguments (C1-C7). Problem solving skills will be developed in tandem with the range of activities described above that are designed to develop their practical skills.

Learning Strategy

In addition to strategies outlined in A above, emphasis shall be on learning 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 provide an opportunity to assess cognitive skills (C1-C7), 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-C7).

D Key/Transferable skills

A successful student shall be able to:

D1 Identify, formulate and solve engineering problems

D2 Communicate effectively

D3 Function in interdisciplinary teams

D4 Effectively use 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 personal computers 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-centered 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 Bioprocess and Post-harvest Engineering degree programme should be able to work in one or a combination of the following areas:

- Food, feed and fibre processing industries
- Warehouses, storage and transport systems
- Design and manufacturing firms for processing and product handling systems
- Controlled environment processing and preservation systems
- NGOs, CBO's
- Institutions of research, consultancy and higher learning
- Government departments
- Self employment

DURATION OF THE DEGREE PROGRAMME
In accordance with the Semester guidelines, the duration of the degree programme in Bioprocess and Post-harvest 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 Bioprocess and Post-harvest Engineering 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.

a) Mature Entrants

Possess a Diploma in any engineering 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 university examination regulations for undergraduate degree programmes, the following regulations will apply for the Bachelor of Science in Bioprocess and Post-harvest 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 Research Project, whose report shall be completed and submitted for examination at least two weeks before the start of the final Semester examinations. Research projects shall be conducted in the last three semesters. A candidate failing in the Research Project shall 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 shall form part of the assessment of the respective succeeding semesters.

(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 on a continuous assessment only 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 12 credits for each semester.

(ii) In order to graduate a student should have accumulated a minimum of 96 credits which will contribute 90% of the overall GPA and the remaining 10% will come from Practical Training.

PRACTICAL TRAINING IN INDUSTRIES

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 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) (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