TAITA TAVETA UNIVERSITY
SCHOOL OF AGRICULTURE, EARTH AND ENVIRONMENTAL SCIENCES
DEPARTMENT OF AGRICULTURAL SCIENCES

MASTER OF SCIENCE IN CLIMATE-SMART AGRICULTURE CURRICULUM

REGULATIONS AND SYLLABUS FOR THE DEGREE OF MASTER OF SCIENCE IN CLIMATE-SMART AGRICULTURE

NOVEMBER, 2022

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1.0 GENERAL INFORMATION ABOUT TAITA TAVETA UNIVERSITY

1.1 Vision, Mission and Core Values

Vision

An educated and transformed society in sustainability of natural resources

Mission

A University for research, education, teaching and community service in management of mineral and other natural resources

Core Values

- Result Oriented
- Quality
- Transparency and accountability
- Innovativeness
- Professionalism and Ethical Conduct

1.2 The Philosophy

Offering quality education, training, research, and outreach programs to empower communities for improvement of their socio-economic wellbeing, while assuring environmental sustainability.

1.3 University Motto

Home of Ideas

The School of Agriculture, Earth and Environmental Sciences will pursue all its endeavours with body, mind and spirit so as to contribute to the university motto.

1.4 Academic Programmes Offered by the University

A list of academic programmes offered by the University is found on its website: www.ttu.ac.ke

2.0 MASTER OF SCIENCE IN CLIMATE-SMART AGRICULTURE CURRICULUM

2.1 Title of the Programme

The programme shall be called "Master of Science in Climate-Smart Agriculture"

2.2 Background

Climate change, particularly an increase in temperature and variability in rainfall has had grave impacts on agricultural productivity, livelihoods, and the environment. Climatic projections point out to a continuous trend in variability in the coming decades which necessitates interventions and strategies for adaptation. Climate-Smart Agriculture (CSA) has gained prominence as an approach for managing the agricultural systems in the face of climate change through enhancing sustainable agricultural production and as an adaptation (resilience in farming) and mitigation (reducing/removal of greenhouse gases) mechanism. As such climate-smart agriculture practices have gained significance both locally and globally as one of the transformation considerations for better productivity with environmental protection. These practices are considered climate-smart as they seek to transform and reorient agricultural development under the new realities of climate change and variability. The development of CSA by incorporating adaptation and mitigation into agriculture development strategies. Nonetheless, global agricultural production systems are still undergoing transformation to modernize climate-smart practices and blend them with technological advancements.

Important to note is that not all climate-smart practices can achieve the triple gains of adaptation mitigation and productivity. The development and application of climate-smart practices are therefore country and context-specific. This fact means a need to promote practices that are applicable in the local context. Additionally, the adoption of these climate-smart practices is influenced by various socio-economic and environmental factors calling out development practitioners to localize the interventions. For more impactful CSA outcomes, countries need to focus on capacity development, with a strong emphasis on technical skills, and newly adapted and tested innovations that solve production challenges. Implementation of CSA policies at the grassroots level, well-coordinated institutional arrangements, information and knowledge sharing, flexible incentives, and sustainable financing mechanisms are recommended for upscaling climate-smart practices. This program is designed to provide quality training for students and CSA professionals, equipping them with the knowledge and skills required in solving the evolving productivity challenges arising from climate change.

2.3 Philosophy of the Programme

Food production faces interlinked challenges with increasing uncertainties from the increasing impacts of climate change and variability. The underlying philosophy of CSA is the development and promotion of an integrative approach that results in landscape management for productive croplands, livestock, forests, and fisheries. It aims for improved food and nutrition security and equitable livelihoods. The program seeks to support the achievement of three outcomes i.e.

increased productivity (producing more food to improve food, nutrition, and income security and livelihood of the world's resource-poor farmers in rural areas); enhanced resilience (contributing to training for reduced vulnerability to drought, pests, disease, and other shocks); reduced emissions (reducing emissions from production systems to protect the environment while increasing productivity); and improved capacity to adapt (increasing productivity in the face of extreme climatic weather patterns). The program anchors on existing knowledge, technologies, and principles of sustainable agriculture. The need to increase carbon sinks and reduce GHGs emissions is a priority consideration, especially during training for a sustainable agro-ecosystem. Its design explicitly focuses on addressing productivity and climate change mitigation and adaptation with consideration of the interactions and tradeoffs existing between them. Finally, the CSA program aims to support funding opportunities for innovation and technology development for extension through research investment.

2.4 Rationale of Programme

2.4.1 Needs Assessment

This curriculum is cognizant that CSA requires a strategic assessment within programs to evaluate the climate smartness of practices, and whether they achieve desired outcomes. The CSA program is evidence-based and brings together knowledge and expertise from various fields working on the thematic area of climate change. The program is tailored to equip learners with the practical knowledge and skills necessary to inform interventions that can help address the challenges of climate change and food security to achieve the stipulated development goals. The curriculum recognizes the role of higher education in building the intellectual capacity of experts who can contribute to innovations and interventions geared towards solving issues arising from the already complex agricultural systems. The program, therefore, aims at providing quality education that will have an impact and enhance the sustainability of the agricultural sector. Students enrolling in the program will have an opportunity to sharpen their skills and expertise in various fields related to CSA development spanning across the global to local arenas.

2.4.2 Stakeholder Involvement

The School of Agriculture, Earth and Environmental Sciences (SAEES) has engaged stakeholders drawn from different sectors, ranging from current and past graduates from the Taita Taveta University (TTU) to representatives of other Universities in Kenya (University of Nairobi and Kenyatta University), private sector practitioners, researchers from international and national research organizations, government and parastatal organizations, national and international non-governmental organizations, among others. The consultations were made through the administration of individual questionnaires to stakeholders via email, and collation of views using various social media platforms. A stakeholders' workshop was convened on 27th and 28th September 2022 to seek further comments on the draft programme and consolidate the responses.

The online survey received responses from 23 stakeholders whereby 56% were female. All the respondents had at least a bachelor's degree while over half had postgraduate qualifications. Fifty-

two percent of the respondents were 35 years and younger. Also, 70% specialized in life sciences. Sixty-five percent were in academia or research while 26% of the respondents were in public policy and governance. All these stakeholders affirmed that this programme is relevant to national development objectives. Eighty-seven percent felt the programme will open up opportunities for career advancement while 96% would recommend the programme to colleagues for skills enhancement. Most preferred either a blended (face-to-face and online) or face-to-face mode of training delivery. The thematic areas of study proposed were all found appropriate, but stakeholders also proposed the following to be considered: Quantitative methods, green technology, gender and social inclusion climate change, entrepreneurship, human-wildlife interaction, and sustainable agriculture.

Their views were consolidated and incorporated into the new Master of Science in Climate-Smart Agriculture curriculum. Among the notable feedback from stakeholders was the need to align the degree program to the requirements of the job market and the prevailing challenges and gaps in the existing farming systems. These issues include climate change impact assessment, land use changes, and policies, potential innovations in soil and water conservation, and entrepreneurship in agro-food systems. These have been addressed in the revised curriculum by enriching the course contents and introducing course units on climate change adaptation and resilient farming systems in drylands, and remote sensing and GIS in land use management.

2.4.3 Justification for the Programme

In Africa, there is increasing urbanization, resulting in farming intensification as a result of increasing food demands. This is similar to other parts of the world, where the global population and changing diets are driving up the demand for food. The situation has been nations struggling to keep up with agricultural production as productivity and yields. The world's farmlands have been faced with major degradation challenges, further decreasing productivity, both from the angle of soil, water and natural resource losses. This has accelerated biodiversity losses with far more consequences of shrinking the food resource base. There are reports of an increasing number of undernourished people to nearly 821 million in 2017, up from 784 million in 2015. The food security challenge is also noted to increase and the world needs to produce about 70% more by 2050 if the estimated 9 billion people are to be fed. The needed increase in productivity needs to have much focus on the sustainable application of technologies that will not affect the environment.

The challenge is intensified by agriculture's extreme vulnerability to climate change. Climate change's negative impacts are already being felt, in the form of reduced yields and more frequent extreme weather events, affecting crops and livestock alike. Substantial investments in adaptation will be required to maintain current yields and to achieve the required production increases. Agriculture is also a major part of the climate problem. It currently generates 19–29% of total Greenhouse Gas (GHG) emissions. Without action, that %age could rise substantially as other sectors reduce their emissions. The program supports the existing Kenya Climate-smart Agriculture National Strategy

(2017-2026) that seeks to mainstream adaptation, build resilience, and mitigate GHG emissions into the agricultural sector for enhanced food and nutrition security and improved livelihoods.

2.4.4 Programme Goal

The course will build the capacity of students to understand climate-change issues, and build the students' analytical skills essential for solving existing and emerging climate-change challenges.

2.4.5 Programme Learning Outcomes

At the end of the program, the learner should be able to:

1. Use the Climate-Smart Agriculture (CSA) approach to incorporate climate change adaptation, and mitigation strategies so as to transform and enhance the resilience of agri-food systems
2. To apply skills and knowledge learned to analyse and formulate policies, strategies, and governance structures for climate change mitigation
3. To conduct evidence-based research whose outcome could inform policies and strategies advocated by development experts in climate change
4. To effectively communicate research results and transfer knowledge to diverse audiences

2.0 MODE OF DELIVERY

The programme will be delivered through blended learning using a combination of in-person and open, distance and e-learning (ODeL). The in-person mode will use various techniques that include didactic lectures, practical, seminars, case-based learning and tutorials. The ODeL approach will include real time and/or asynchronous audio-visual and e-learning materials.

3.0 ADMISSION REQUIREMENTS

3.1 Minimum Admission Requirements

Candidates must satisfy the minimum requirements laid down in the University Common regulations for Masters Degrees and the School of Agriculture, Earth and Environmental Sciences common regulations.

In addition, candidates should have;

i. Holders of a Bachelor's degree with at least Second Class Honours (Upper Division) in Agricultural Sciences or in related disciplines such as Environmental Studies, Natural Resources Management, Wildlife and Tourism Management, Agricultural Engineering, Animal Health Sciences Urban & Regional Planning, Biological and Physical Sciences, Ecology, Biodiversity, Development Studies, Geography, Economics and related fields, from Taita Taveta University or any other recognized university OR

ii. Holders of a Bachelor's degree with at least Second Class (Lower Division) in Agricultural Sciences or in related disciplines such as Environmental Studies, Natural Resources Management, Wildlife and Tourism Management, Agricultural Engineering, Animal Health Sciences Urban & Regional Planning, Biological and Physical Sciences, Ecology, Biodiversity, Development Studies, Economics, Geography and related fields, from Taita Taveta University

or any other recognized university, with evidence of at least one year relevant working experience OR

iii. Holders of a Bachelor's degree with a Pass in Agricultural Sciences or in related disciplines such as Environmental Studies, Natural Resources Management, Wildlife and Tourism Management, Agricultural Engineering, Animal Health Sciences Urban & Regional Planning, Biological and Physical Sciences, Ecology, Biodiversity, Development Studies, Geography, Economics and related fields, from Taita Taveta University or any other recognized university, with evidence of at least three years relevant experience OR

iv. Holders of a Bachelor's degree with a Pass in Agricultural Sciences or in related disciplines such as Environmental Studies, Natural Resources Management, Wildlife and Tourism Management, Agricultural Engineering, Animal Health Sciences Urban & Regional Planning, Biological and Physical Sciences, Ecology, Biodiversity, Development Studies, Geography, Economics and related fields, from Taita Taveta University or any other recognized university, with evidence of at least two years relevant experience and an earned post graduate diploma in a relevant field OR

v. Holders of Postgraduate Diplomas from Taita Taveta University or any other institution recognized by the Senate of Taita Taveta University. Such candidates must satisfy the minimum requirements for admission to a Masters degree.

vi. Students from non-English speaking countries will be required to have a proficiency certificate for the English language.

3.2 Credit Transfers and Exemptions

3.2.1 A candidate may be exempted from some course units and credit transferred from university or any other equivalent institution recognized by the senate of Taita Taveta University, subject to the following conditions:

3.2.2 Credit transfer shall only apply for course units.

3.2.3 Must have passed a similar course unit at Masters Level.

3.2.4 A candidate may be allowed to transfer up to a maximum of one-third of taught units.

3.2.5 Requests for credit transfer should be made in writing on admission through the Dean, School of Agriculture, Earth and Environmental Science to the Academic Registrar and must be accompanied by officially endorsed supporting documents, transcripts and institution/university catalogue for the relevant course.

3.2.6 Application for transfer of credit shall be processed only after payment of prescribed fees.

4.0 COURSE REQUIREMENTS

4.1 Student Obligations

4.1.1 Must attend lectures, complete assignments and practical sessions in consultation with the lecturers and technologists.

4.1.2 Must attend regular progress meetings and ensure quarterly progress reports are submitted in time.

4.1.3 Must attend at least two-thirds of the lecture sessions in the course unit to be eligible to sit for the final assessment.

4.1.4 Enrol for all course units within the first three weeks at the beginning of the semester in question.

4.1.5 Ensure they carry out their research in consultation with all supervisors. Timely completion of the research and thesis submission for examination shall remain a priority to all masters' students.

4.1.6 Must attend scheduled seminars and presentations.

4.2 Lecturer Obligations

4.2.1 Ensure full coverage of the syllabus promptly and facilitate lectures, discussions and practical sessions.

4.2.2 Assess student practical and oral presentations.

4.2.3 Set, invigilate and mark examinations as timetabled.

4.2.4 Guide, mentor and supervise students.

4.2.5 The supervisors of students undertaking thesis research shall ensure timely assessment of the research process including holding regular progress meetings. Records of progress meetings shall be filed at the Chairman's office.

5.0 STUDENT ASSESSMENT CRITERIA

The students shall be assessed for all course units taught and will be assessed through the following:

5.1 Coursework

5.1.1 Continuous assessment tests based on completion of assignments, practicals, term papers, seminars, oral presentations and written tests.

5.1.2 Seminars shall constitute an integral component of continuous assessment in each course unit. The lecturer responsible shall equip the learners with skills and assess them on ability to critique journal publications, present scholarly papers orally, and lead scholarly discussions in the specialization of that course unit.

5.1.3 End of semester written examination. Each taught course will be examined by a 3-hour written examination at the end of the semester.

5.2 Thesis

Thesis examination shall follow common regulations of the University that include, but are not limited to:

5.2.1 Oral presentation of the proposal at the Department.

5.2.2 Submission of the written proposal document.

5.2.3 Progress reports and findings.

5.2.4 A written M.Sc. thesis.

6.0 GRADING SYSTEM

The grading system of each taught course unit shall be as follows:

Grade	Range
A	70 - 100%
B	60 - 69%
C	50 - 59%
Fail	Below 50%

7.0 EXAMINATION REGULATIONS

7.1 Coursework Examination

7.1.1 The common examination regulations for the masters' degree programme in the Taita Taveta University shall apply.

7.1.2 All the units taken in a given semester shall be examined at the end of that semester unless otherwise specified.

7.1.3 A candidate shall not be allowed to sit any examination unless he or she has attended at least two-thirds of the total course hours.

7.1.4 Each course shall be evaluated in terms of units with one unit being 45 lectures and practical hours.

7.1.5 A written end of semester examination for each unit, where it applies, shall have a duration of three hours.

7.1.6 The end of the semester examination and the continuous assessment shall constitute

7.1.7 60% and 40% of the total marks respectively.

7.1.8 The pass mark for each course unit shall be 50%.

7.1.9 A candidate who fails in four or fewer course units shall, on the recommendation of the Faculty Examiners Committee and approval by the Senate, be allowed to take up to two supplementary examinations. Failure in 2 consecutive supplementary, will lead to expulsion.

7.1.10 A pass mark obtained after a supplementary examination shall be recorded as 50% in the candidate's transcript.

7.1.11 A candidate shall be required to pass all taught units to be eligible to undertake an M.Sc. thesis.

7.1.12 Taita Taveta University regulations in relation to examination malpractices, disciplinary actions and mode of appeal shall apply.

7.2 Thesis Examination

Thesis examinations will be governed by common regulations of Taita Taveta University:

7.2.1 With the approval of the supervisor, each candidate will submit a written report of the thesis for examination.

7.2.2 The candidate shall present the thesis orally before a panel of examiners.

7.2.3 A candidate shall be required to show evidence of progress for publication of at least one article.

7.2.4 A candidate, who fails to submit a thesis report or fails in the second resubmission of the thesis, on the recommendation of the Faculty Examiners Committee and approval by the senate, shall be discontinued.

7.3 Examination Moderation

7.3.1 Examinations shall be moderated internally and externally to ensure they meet the University standards. A qualified external examiner who will be appointed by the Senate of Taita Taveta University in consultation with the Department shall be invited to moderate the end of semester assessment.

7.3.2 The Internal examiner sets the examination paper and incorporates the corrections suggested by both the internal moderator and the External Examiner. S/he also marks the examination scripts and considers the changes suggested by the External Examiner.

7.3.3 The External Examiner moderates both the draft examination papers and the marked examination scripts and where necessary suggests changes. S/he ensures that the syllabus coverage is adequate and the standards of setting and marking are high.

8.0 GRADUATION REQUIREMENTS

8.1 Award of the Degree

8.1.1 The degree to be awarded shall be Master of Science (M.Sc.) in Climate-Smart Agriculture

8.1.2 To qualify for the graduation and the award of the degree of Master of Science in Climate-Smart Agriculture, the candidate shall meet the following requirements:

a) Carry out research and successfully defend the M.Sc thesis.
b) Show progress of at least ONE research article from their thesis research for publication.
c) Meet all university graduation requirements including clearance and payments of convocation fees.

8.2 Classification of the Degree

The degree shall not have classification.

9.0 DESCRIPTION OF THESIS

Upon successful development of research proposal and data collection, the candidate shall be required to write a thesis presenting his/her research and findings in support of candidature for the degree of Master of Science in Climate-Smart Agriculture

9.1 Rationale for the Thesis in the Programme

The thesis is an academic report of the research project findings that is examinable to complete the requirements for the award of the degree. The thesis shall be submitted to the Dean School of Agriculture, Earth and Environmental Sciences in partial fulfilment of the requirements for the degree.

9.2 Facets of the Thesis

The thesis structure shall follow common regulations of Taita Taveta University. At the minimum, the thesis shall comprise the abstract, introduction, literature review, methodology, results and discussion, conclusions and recommendation, references and relevant appendices.

9.3 Regulations of the Thesis

9.3.1 A candidate shall present a master's thesis proposal to the Department of Agricultural Sciences

9.3.2 All proposals and theses must adhere to the University plagiarism policy and must therefore be accompanied by a signed certificate of originality.

9.3.3 A candidate shall consult their supervisors at least once a month and shall submit quarterly progress reports to the School of Agriculture, Earth and Environmental Sciences through the supervisors, Chairman of the Department.

9.3.4 A candidate shall be required to attend, participate and present their progress in at least one seminar at the Department and or Faculty or any recognized forum.

9.3.5 A candidate shall be required to record all raw data in a research notebook and shall submit the same regularly to be evaluated by the supervisor. Laboratory notebooks shall be kept at the department for at least seven years after the candidate's graduation.

9.3.6 Submission of the MSc. thesis for examination must adhere to the School of Agriculture, Earth and Environmental Sciences, process and regulations on thesis examination.

10.0 COURSE EVALUATION

The delivery of MSc. Climate-Smart Agriculture shall be guided by applicable procedures and practices of Taita Taveta University's Quality Management System that include:

10.1.1 Evaluation of delivery of taught course units at the end of the semester as prescribed by the procedure for teaching.

10.1.2 Taita Taveta University's internal quality audits monitor conformance to set standards.

10.1.3 Recommendations of external examiners on quality improvements in the delivery of 0the course, appropriateness of the content and management of examination.

11.0 MANAGEMENT AND ADMINISTRATION

11.1 Programme Placement

The programme shall be domiciled at the Department of Agricultural Sciences, in the School of Agriculture, Earth and Environmental Sciences, Taita Taveta University.

11.2 Academic Leadership

The programme shall be headed by an academic leader who has a PhD in Agricultural or Environmental Sciences and possesses more than five (5) years of university teaching experience. S/he should also be at the rank of a Senior Lecturer and above. Appointed by the Dean of School of Agriculture, Earth and Environmental Sciences, the academic leader shall be responsible for:

a) Curriculum design, scheduling and delivery
b) Assessment of students and records thereof
c) Planning and management of curriculum development and review

d) Monitoring and evaluation of the programme
e) Management of feedback from students, external examiners, professional, statutory and regulatory bodies
f) Appointment, coordination and communication with/ of class representatives
g) Coordination of course lecturers
h) Specifications for resources that support the programme
i) Quality assurance
j) Student academic tracking and records
k) Promotion of the programme and student enrolment
l) Staff development and training
m) Establishment and sustenance of networks and collaborations that support the programmes
n) Promotion of discipline-specific research, especially involving students
o) Mentorship of students.
p) Other related activities.

11.3 Quality Assurance Mechanisms

Quality Assurance of the programme shall be through assessment, review, teaching and examinations as shall be guided by the applicable procedures and practices in Taita Taveta University. The programme has a rigorous quality assurance mechanism that includes the following:

11.3.1 Students must sign the class attendance sheet and countersign it by the lecturer
11.3.2 Students and lecturers sign a continuous and examination attendance sheet whenever such assessments are done
11.3.3 All the programmes written examinations undergo both internal and external moderations
11.3.4 Every semester, students evaluate their lecturers after the course for regular review as necessary.
11.3.5 Examination results are subjected to the School Academic Committee approval process before being adopted.

12.0 COURSE UNITS OFFERED

The programme consists of fourteen (14) examinable courses. Each course unit has a loading of 45 hours. The thesis shall be equivalent to 7 course units.

12.1 List of Courses

Semester 1		**Lecture**	**Practical**	**Total**
Code	**Course Title**	**Hours**	**Hours**	**Hours**
SAE 3101	Biostatistics	30	15	45
SAE 3102	Research Methods and Scientific Communication	30	15	45
SAE 3103	Advanced of Remote Sensing and GIS	30	15	45
SAE 3104	Climate Change Adaptation and Resilience	45	-	45
SAE 3105	Advanced Project Planning and Management	45	-	45
ACA 3101	Biotechnology in Food Systems	30	15	45
ACA 3102	Climate Change and Agro-biodiversity	30	15	45
Semester Hours				**315**
Semester 2				
ACA 3103	Gender, Youth and Social Inclusion in Agriculture	45	-	45
ACA 3104	Knowledge Management for Sustainable Agriculture	45	-	45
ACA 3105	Climate Change Policy and Governance	45		45
ACA 3106	Renewable Energy and Sustainable Agriculture	30	15	45
ACA 3107	Agricultural Production systems and Circular Economy	30	15	45
ACA 3108	Climate Risk Analysis and Modelling	30	15	45
ACA 3109	Economics of Climate Change	45	-	45
Semester Hours				**315**
	Thesis (equivalent to 7 units)			**315**

12.2 Course Duration and Structure

12.2.1 The programme shall take two (2) academic years of four (4) semesters.

12.2.2 An academic year shall constitute 2 semesters.

12.2.3 The Master of Science in Climate Smart Agriculture Management shall be offered by course work, end of semester assessment, research and thesis. Course work shall not exceed one year.

12.2.4 A total of twelve (14) course units shall be undertaken and passed by the student.

12.2.5 A course unit shall be defined as 45 instructional hours consisting of lectures, tutorials, seminars assignments and practicals.

12.2.6 The student shall carry out supervised research culminating in a Master's Thesis.

12.3 Course Matrix

Programme Learning Outcomes	**First Year**
1. Use the Climate-Smart Agriculture (CSA) approach to incorporate climate change adaptation, and mitigation strategies so as to transform and enhance the resilience of Agri-food systems	SAE 3103; SAE 3104; ACA 3106; ACA 3109; ACA 3108; ACA 3107
2. To apply skills and knowledge learned to analyse and formulate policies, strategies, and governance structures for climate change mitigation	ACA 3105; ACA 3106; ACA 3109; ACA 3108; ACA 3107
3. To conduct evidence-based research whose outcome could inform policies and strategies advocated by development experts in climate change	ACA 3106; ACA 3109; ACA 3108; ACA 3107
4. To effectively communicate research results and transfer knowledge to diverse audiences	SAE 3101; SAE 3102; ACA 3104