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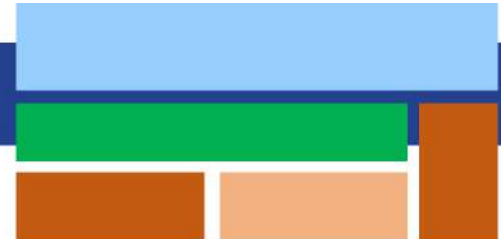
MASTER OF SCIENCE IN FOOD SECURITY AND CLIMATE CHANGE (MS FSCC)

Core, Specialization, and Elective Courses of the MS FSCC

The Master of Science in Food Security and Climate Change (MS FSCC) is a joint degree developed under the ERASMUS+ Capacity Building for Higher Education funding from 2016-2019. All Core Courses and the six Core Specialization Courses have been developed jointly by the member universities of the Southeast Asian University Consortium for Graduate Education in Agriculture and Natural Resources (UC): Kasetsart University (KU) in Thailand, Universiti Putra Malaysia (UPM) in Malaysia, the University of the Philippines Los Baños (UPLB) in the Philippines, Institut Pertanian Bogor (IPB) and Universitas Gadjah Mada (UGM), both in Indonesia.

Project Members:





PROGRAMME GUIDE

To be awarded the degree of Master of Science in Food Security and Climate Change, a student needs to finish 40 units or credits within the span of four semesters (or two years), broken down as follows:

Courses	Credit
Core Courses	15
Specialization Courses	13
Thesis	12
TOTAL	40

PROGRAMME STRUCTURE

First Year	
1st Semester	2nd Semester
12 units core courses	3 units core courses 9-10 units of specialized courses
Second Year	
1st Semester	2nd Semester
3-4 units of specialized courses 3 or 6 units of thesis	3 or 6 units of thesis

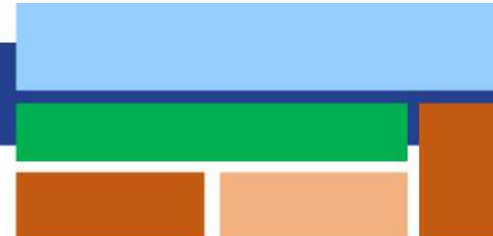
CORE COURSES

COURSE NO.	COURSE TITLE
FSCC 501	Changing Climate and Its Impacts on Natural Resources, Agriculture and Food Security
FSCC 502	Food Security and Food Systems in a Dynamic Environment
FSCC 503	Impact Assessment and Evaluation of Projects and Policies
FSCC 504	Sustainability Assessment in Agricultural Production and Food Processing (MS FSCC Summer School)
FSCC 591	Research Methods
FSCC 597	Seminar

PROGRAMME CORE COMPETENCIES

All graduates of the MS FSCC programme are instilled with six programme core competencies. These programme competencies are as follows:

1. Assess biophysical mechanisms of contribution to, adaptation to and mitigation of climate change in agriculture and food processing
2. Capacity to assess any technical production system (farming, forest, food processing) from a sustainability point of view
3. Be able to command studies, or implement assessment of public policies and technologies on both production and sustainability point of view
4. Capacity to identify problems and research question, and to set up an appropriate mechanism of research that can respond to the question
5. Capacity to identify issues, concerns, challenges and assess food security situation at different level
6. Capacity to effectively communicate and manage projects and institutions



Course Title: Changing Climate and Its Impacts on Natural Resources, Agriculture and Food Security

Course Prerequisite: None

Course Description: This course encompasses the science of climate change, its causes, signs, and impacts on natural resources and agricultural systems; mitigation and adaptation strategies are also covered.

Course Credit: 3 units

Course Goal: Upon completion of the course, the student should be able to assess biophysical mechanisms that contribute to climate change, the impacts of these changes, and what adaptation and mitigation options are available for the agriculture and natural systems.

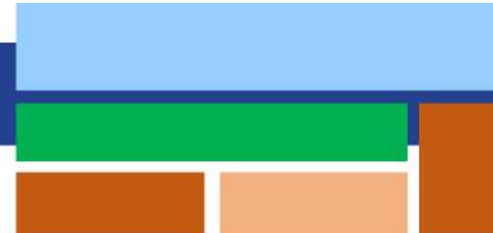
Course Outcomes:

At the end of the course, the student should be able to:

1. Discuss the science of climate change and its observed evidences at the global and regional scales;
2. Explain the anthropogenic drivers of climate change, including biophysical and socioeconomic processes resulting to GHG emissions; different climate scenarios and projections;
3. Examine the impacts of changing climate to natural resources, agriculture and food security; and
4. Discuss adaptation and mitigation strategies in natural resources, agriculture and food security.

Course Mapping

Course outcomes	Professional profile			Core Competencies					
	PM	DO	RE	1	2	3	4	5	6
CO1 Discuss the science of climate change and its observed evidences at the global and regional scales.	/	/	/	/			/		/
CO2 Explain the anthropogenic drivers of climate change, including biophysical and socioeconomic processes resulting to GHG emissions; different climate scenarios and projections.	/	/	/	/			/		/
CO3 Examine the impacts of changing climate to natural resources, agriculture and food security.	/	/	/	/		/	/		/
CO4 Discuss adaptation and mitigation strategies in natural resources, agriculture and food security.	/	/	/			/	/	/	/



Course Outcomes

Week	Course outcomes	Topics	Teaching and Learning Activity	Assessment tool	Number of hours
1	CO1	Introduction Earth and the Climate Systems	Lecture Discussion	Exams, Assignments,	3
2, 3	CO1	Signs of climate change <ul style="list-style-type: none"> • Temperature rise • Precipitation • Extreme Events • Sea level rise 	Lecture, SCL (e.g. Discussion, Reporting Self-study, Guided readings)	Exams, Assignments	6
4, 5	CO2	Anthropogenic drivers of climate change <ul style="list-style-type: none"> • Deforestation • Population • Industrialization 	Lecture Discussion Reporting Debates Role playing	Exams Assignments, Participation in class activities (e.g., debates, role playing, etc.)	6
6, 7	CO2	Climate change projections and climate scenarios	Lecture, SCL (e.g. Discussions, case examples)	Exams, Assignments	6
8, 9	CO3	Climate change impacts on natural resources <ul style="list-style-type: none"> • Water and watersheds • Land • Biodiversity 	Lecture Discussions Reporting	Exams, Assignments, Case analysis, Participation in class activities (e.g., debates, role playing, etc.)	6
10, 11	CO3	Climate change impacts on agriculture <ul style="list-style-type: none"> • Crop production • Livestock production • Fisheries (Aquaculture, open fisheries) 	Exams, Assignments, Case analysis (SCL/PBL)	Exams, Assignments,	6
12	CO3	Climate change impacts on food security	Case analysis	Exams, Assignments Case analysis,	3

13	CO4	<p>CC Adaptation Strategies for Food Security</p> <ul style="list-style-type: none"> • Risk transfer mechanism • Early warning systems and drought forecasting using remote sensing • Better use of seasonal climate forecast for adjusting planting schedules • Vulnerability and risk-based adaptation planning 	<p>Field visits Lecture Discussion</p>	<p>Examination Assignments, Case analysis, Participation in class activities (e.g., debates, role playing, etc.)</p>	3
14	CO4	<p>Mitigation Strategies to Reduce Carbon Footprint of Food Value Chain</p> <ul style="list-style-type: none"> • Estimating GHG emission in a value chain • GHG inventory-based mitigation planning <p>Synthesis: Way forward to sustainable food production system</p>	<p>Lecture-Discussion Class exercise</p>	<p>Examination, Assignments,</p>	3

Assessment:

Assessment Task	Course outcomes	Weight in final grade	Minimum average for satisfactory performance
Mid-term exam	1,2,3,4	30	75%
Final exam	1,2,3,4	30	
Case analysis	3,4	20	
Assignments	1,2,3,4	10	
Class participation	1,2,3,4	10	

Course Title: Food Security and Food Systems in a Dynamic Environment

Course Description: This course covers the concepts of food security and the food system including production and processing. The socio-economic impact to food security is also discussed.

Course Prerequisite: None

Course Credit: 3 units

Course Goal: At the end of the course, the students are expected to obtain a good understanding of food security and increase awareness of food security issues.

Course Outcomes:

At the end of the course, the student should be able to:

1. Understand the concepts of food security with emphasis on the four dimension of food security
2. Analyse information relating issues of food systems and food security at the national and international level
3. Assess food and nutrition security at various levels

Course Mapping:

Course Outcomes	Professional Profile			Core Competencies					
	PM	DO	RE	1	2	3	4	5	6
CO1 Understand the concepts of food security with emphasis on the four dimension of food security	/	/	/					/	/
CO2 Analyse information relating issues of food systems and food security at the national and international level		/	/					/	/
CO3 Assess food and nutrition security at various levels	/	/	/					/	/

Course Content:

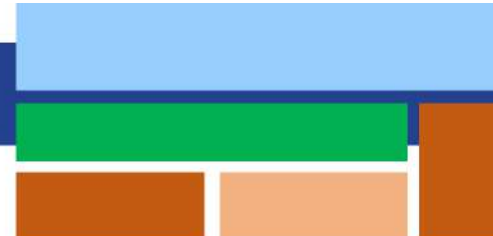
Week	Course Outcomes	Topics	Teaching and Learning Activity	Assessment Tool	No. of Hours
1	CO1	I. Overview of Food Security and Food System A. Four Pillar of Food Security According to FAO B. Overview of Food Systems	Lecture/ Discussion	Exam	3

		C. Dynamic Environment			
2-3	CO1	II. Food Production systems and security A. Agricultural Crops Production B. Livestock Production C. Aquaculture Production	Lecture/ Discussion	Quiz Exam	6
4	CO2	III. Food Processing A. Overview of Food Processing and Distribution B. Processing Methods C. Emerging Technologies	Lecture/ Discussion	Exam Assignment	3
5	CO2	IV. Food Quality and Safety A. Quality Assurance B. Traceability system C. Certification D. Issues on Food Safety	Lecture/ Discussion	Exam Assignment	3
6-7	CO2	V. Food and Nutrition Security A. Balance diet B. Human Health C. Importance of Nutrition Security D. Food Diversification as affected by nutritional requirements	Lecture/ Discussion	Exam Assignment	6
8,9	CO2,CO3	VI. Socio-economic Impact of Food Security A. Distribution and food accessibility B. Green supply chain C. Market/price and climate risks D. Consumer preference E. Food diversification as affected by socio-economic factors	Lecture Discussion	Exam Presentation	6

10	CO2,CO3	VII. Food security initiatives A. Food security policies B. Roles of organizations and institutions in the value chains C. Capacity building and empowerment of stakeholders	Lecture/ Group discussion	Exam/ Report	3
11,12	CO3	VIII. Assessment of Food Security A. Parameters of food security B. Levels of analysis (regional, national, household, individual) C. Assessment tools and data requirement	Lecture Presentation	Exam/ Problem Based Learning	6
13,14	CO3	IX. Current issues in Food Security A. Agri-food Policy B. Trade Liberation C. Food Distribution D. Changing consumer Preferences E. Nutrition and Health	Discussion Presentation	Exam/ Problem Based Learning	6

Assessment:

Assessment Task	Course Outcome (CO)	Weight in Final Grade	Minimum Average for Satisfactory Performance
Exam	CO1	20%	65-80% or B
Assignment (Problem Based Learning)	CO3	50%	65-80% or B
Final Exam	CO1 & CO2	30%	65-80% or B



Course Title: Impact assessment and evaluation of projects and policies

Course Description: Concepts, methods, and tools for environmental, social, and economic evaluation

Course Prerequisite: None

Course Credit: 3 units (42-48 hours)

Course Goal: This course encompasses theoretical and empirical tools for evaluation of actions, projects, and policies related to food security and climate change.

Course Outcomes:

After taking the course, the students will be able to:

1. Discuss the concepts, tools and methods related to evaluation of projects and policies
2. Analyze the impact of existing projects and policies related to food security and climate change
3. Professionally evaluate projects and policies

Course Mapping:

Course Outcomes	Professional Profile			Core Competencies					
	PM	DO	RE	1	2	3	4	5	6
CO1 Discuss the concepts, tools and methods related to evaluation of projects and policies	/	/	/			/			/
CO2 Analyze the impact of existing projects and policies related to food security and climate change	/	/	/			/			/
CO3 Professionally evaluate projects and policies	/	/	/			/	/		/

Course Content:

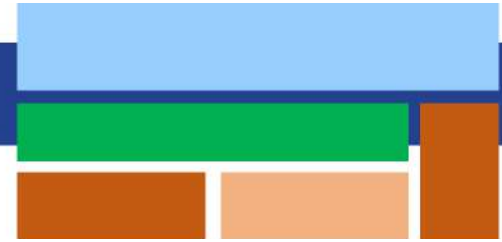
Week	Course Outcomes	Topics	Teaching and Learning Activity	Assessment Tool	Number of Hours
1-2	CO1	I. Evaluation of Projects and Policies <ul style="list-style-type: none"> • Evaluation criteria • Role of Assessment and Evaluation in Project Cycle • Three pillars in Sustainable Development 	Lecture, group discussion	Diagnostic test	6 hours

		(Economic, Social, Environmental aspects)			
3-4	CO1	<p>II. Tools and Methods for Economic Impact Assessment</p> <ul style="list-style-type: none"> • Economic criteria (productivity, investment) • Cost-benefit analysis and other tools 	Lecture, individual exercise, group discussion	Quiz	6 hours
5-6	CO1	<p>III. Tools and Methods for Social Impact Assessment</p> <ul style="list-style-type: none"> • Social criteria (diversity of livelihood, empowerment, gender etc.) • Social cost-benefit analysis (equity; micro, meso, macro) • Participatory Rural Approach, FGD, Delphi etc. 	Lecture, individual exercise, group discussion	Homework assignment	6 hours
7-8	CO1	<p>IV. Tools and Methods for Environmental Impact Assessment</p> <ul style="list-style-type: none"> • Environmental criteria (biodiversity, deforestation, land erosion etc.) • Technical Quantifying of Environmental Aspects 	Lecture, individual exercise, group discussion	Presentation mark, mid-exam (topic 1-4)	6 hours
9-11	CO2	<p>V. Valuation Methods</p> <ul style="list-style-type: none"> • Market based methods • Surrogate market based methods • Hypothetical market based methods 	Lecture, individual exercise, group discussion	Presentation mark	9 hours

12-16	CO3	<p>VI. Integrating Economic, Social and Environmental Aspects in Impact Assessment</p> <ul style="list-style-type: none"> Impact assessment on existing projects or policies (from problem identification up to final report) 	<p>Short lecture, field survey, guest lecture from various stakeholders (private and public), case study, group presentation and discussion</p>	<p>Presentation and paper mark</p>	<p>12 hours</p>
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Assessment:

Assessment Task	Course Outcome	Weight in Final Grade	Minimum Average for Satisfactory Performance
Diagnostic and evaluation tests	CO1, CO2, CO3	10%	65-80% or B
Quiz	CO1	5%	65-80% or B
Exams	CO1, CO2, CO3	40%	65-80% or B
Homework	CO1	5%	65-80% or B
Paper submission	CO3	25%	65-80% or B
Oral presentation	CO1, CO2, CO3	15%	65-80% or B



Course Title: Sustainability Assessment in Agricultural Production and Food Processing

Course Description: Active learning exercise to train students to assess the dynamics of change, innovation and adaptation to transitions in rural areas.

Course Prerequisite: Basic knowledge in agricultural sciences and economics. Motivation for fieldwork

Course Credit: 2

Semester Offered: Summer school (block course)

Course Goal: To acquaint students with theories, methods, and practices to understand and facilitate transitions in natural resources management. This includes the identification of appropriate entry points and the design of facilitation measures to accompany complex social, ecological and economic transitions. Students learn how to assess the diversity of farming systems and rural livelihoods, how then to accelerate change and how changes at practical level correspond with the relevant institutions and policies.

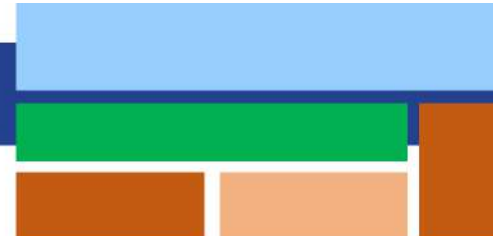
Course Outcomes:

After taking the course, the students will be able to:

1. Assess the agrarian situation in a delimited area
2. Identify and assess the dynamics of change (innovation, intensification, diversification, market integration) within the diversity of local systems
3. Formulate proposals for facilitating the adaptation/innovation/transition

Course Mapping:

Course Outcomes	Professional Profile			Core Competencies					
	PM	DO	RE	1	2	3	4	5	6
CO1 : Capacity of assessment of the agrarian situation in a delimited area.	**	**	**		***		***		
CO2: Capacity to identify and assess the dynamics of change (innovation, intensification, diversification, market integration) within the diversity of local systems	**	**	**		**		***	*	
CO3 : Capacity to formulate proposals for facilitating the adaptation/innovation/transition	**	*	***				***	***	

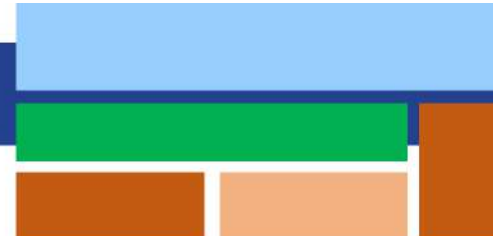


Course Content:

Week	Course Outcomes	Topics	Teaching and Learning Activity	Assessment Tool	Number of Hours
1A	CO1	Preparation of the field work Concepts of systems (farming, cropping, animal rearing) Innovation and change processes. Criteria of evaluation Problem identified Elaboration of questions	4 h lectures + assignments	Presentations	20
1B	CO1	Field work and permanent data analysis	Observations and surveys on the field	Reports on surveys	30
2A	CO2	Field work (cont'd) and permanent data analyzing	Observations and surveys on the field	Reports on surveys	30
2B	CO3	Organization of the conclusions and feedback sessions	Group work	Presentation at the feedback session Reports of groupwork	20

Assessment:

Assessment Task	Course Outcome	Weight in Final Grade	Minimum Average for Satisfactory Performance
Group presentations, groupwork		40%	C
Attitudes at fieldwork		15%	C
Presentation at feedback session		20%	D
Individual exam		25%	C



Course Title: Research Methods / Research Design and Planning

Course Description: Present analytical methods in natural, applied, and social sciences and discuss alternative scientific and methodological options. Students will be exposed to a wide range of research methods and will learn key principles of research design. The course includes practical exercises of conception of a survey and data collection.

Course Prerequisite: None

Course Credit: 3

Course Goal: To construct research proposal based on problems and/or questions and design a research plan. The students know scientific methods for data collection, data analysis, and evaluation of the results.

Course outcomes:

After taking the course, the students will be able to:

1. Identify problems and transform these into research questions.
2. Design a research plan with ethical considerations.
3. Construct a research proposal.
4. Collect, combine, and analyse data, by all kinds of means (observations, measurements, surveys, interviews, focus groups)
5. Evaluate results, qualitative and quantitative.

Course Mapping:

Course Outcomes	Professional Profile			Core Competencies					
	PM	DO	RE	1	2	3	4	5	6
CO1: Capacity to identify problems and transform these into research questions.	/	/	/				/		
CO2: Capacity to design a research plan with ethical consideration.			/				/		/
CO3: Capacity to construct a research proposal.			/				/		/
CO4: Capacity to collect, combine and analyse data.		/	/				/		
CO5: Capacity to evaluate results.	/	/	/				/		

Course Content:

Week	Course Outcomes	Topics	Teaching and Learning Activity	Assessment Tool	Number of Hours
1	CO1	Introduction <ul style="list-style-type: none"> • The role of research • Research process overview 	Lecture/group discussion		3

2	CO1	<p>Problems and Hypotheses</p> <ul style="list-style-type: none"> Defining the research problem, formulation of the research hypotheses. The importance of problems and hypotheses. 	Lecture/group discussion/presentation		3
3-4	CO2	Literature search and review	Lecture/ groupwork on assessing different databases and feedback		6
5-6	CO2	<p>Research design</p> <ul style="list-style-type: none"> Experimental research (quantitative, qualitative, and mixed methods approaches) Nonexperimental research design, field research <p>survey research</p> <p>Sampling techniques</p> <ul style="list-style-type: none"> The nature of sampling Probability sampling design Non-probability sampling design Determination of sample size 	Lecture/group work/presentation		6
7-8-9	CO4	<p>Practical :</p> <ul style="list-style-type: none"> choice of a problem elaboration of questions, conception of a survey, sampling, interviews, data analysis, conclusions 	Groupwork and practical		9
10	CO4	Assessment of the practical	Group discussion		3

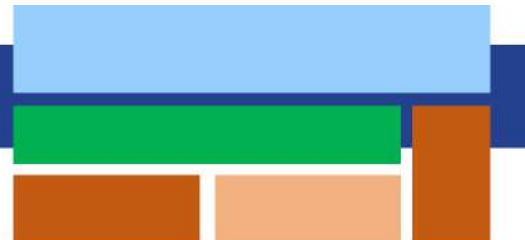
11	CO4	Ethical issues in conducting research	Lecture/ group discussion/ presentation		3
12-13	CO2	Constructing a research proposal <ul style="list-style-type: none"> • making a case for research • using theories to underpin the research • develop propositions/hypothesis • research framework/conceptual models • a fully justified research design • sampling and significance of the study • Resources required and a timetable for project completion 	Reverse pedagogy : no lecture, but readings distributed, groupworks, feedback sessions on – role of theories, progress of knowledge, elaboration of hypothesis, significance...		6
14-15	CO3	Processing and analysis of data <ul style="list-style-type: none"> • Qualitative data analysis and interpretation • Quantitative data analysis and interpretation 	Lecture and practice on case studies		6

Assessment:

Assessment Task	Course Outcome	Weight in Final Grade	Minimum Average for Satisfactory Performance
A complete research proposal	CO2, CO3	40%	
Evaluation of attitudes and results of practical	CO4	30%	
Exam	CO1, CO5	30%	

CORE SPECIALIZATION COURSES

SPECIALIZATION AREA	COURSE TITLE
Agriculture and Animal Sciences	Climate-smart Animal and Crop Production Systems
Forestry	Forests and a Changing Climate
Food Science	Postharvest, Processing and Distribution in Changing Climate
Climate Sciences	Climate Risk Management for Food Security
Public Policy and Economics	Economics and Policy Issues in Food Security and Climate Change
	Economic Valuation for Food Security and Climate Change



Specialization Area: Agriculture and Animal Sciences

Specialization outcomes

1. Understand the implications to climate change and food security of current practices and recent advances in various crop /animal production systems
2. Describe the characteristics of a climate smart animal/crop production system
3. Critical assessment and analysis of the environmental, technical, and socio-economic implications of an existing and proposed animal/crop production systems
4. Determine site-specific climate smart options to improve sustainability of animal/crop production systems
5. Analyze specific issues on food security and climate change in crop/animal production issues

Core Specialization Course:

Course Title: Climate-smart Animal and Crop Production Systems

Course Credit: 3 units

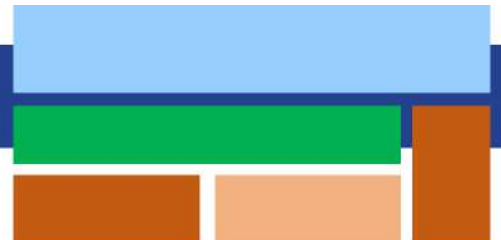
Course Description: Climate smart innovative strategies and technologies in animal and crops production systems in the tropics

Core course outcomes (Climate smart AGRI)

1. Explain the impact of climate change in animal and crop production systems Explain the impacts of climate change in animal and crop production systems
2. Analyze main characteristics of climate-smart agricultural systems
3. Formulate plans for the full adoption of climate smart agriculture in the tropics

Course Mapping:

Course Outcomes (CO)	Professional Profile			Core Competencies						Expected Capacities		
	PM	DO	RE	1	2	3	4	5	6	K	S	A
CO1: explain the impact of climate change in animal and crop production systems				/	/							
CO2: analyze main characteristics of climate-smart agricultural systems				/	/		/	/		/	/	
CO3: formulate plans for the full adoption of climate smart agriculture in the tropics				/	/	/	/	/			/	



Course Content:

Week	Course Outcomes	Topics	Teaching and Learning Activity	Assessment Tool	Number of Hours
	CO1	Impacts of Climate Change in Animal and Crop Production A. Environment B. Socio-economic C. Technological	Lecture and Self-study (e.g. case study analyses)	Exam	9
	CO1, CO2	Elements of Climate-Smart Agricultural Systems in the Tropics	Lecture	Exam	15
	CO2	Innovations and Technology in Climate-Smart Farming	Field Visits	Oral Report	9
	CO3	National and Global Issues on the Use of Climate-Smart Agriculture	Seminar workshops	Case Study	15
				Exams	2
				Total	48

Specialization Elective Courses:

Practices and Advances in Crop Production Systems

Course Description: Management practices and recent advances towards increasing productivity, profitability and sustainability of various crop production systems.

Crop Physiology and Environment

Course Description: Elucidation and evaluation of the response of crops to climate and other environmental changes, their effects on crop growth and productivity and implications to crop management

Crop Pests and Diseases Ecology and Management

Course Description: Practices and recent advances in plant disease and pest management; pest residues their fate in environment and ecological significance host-pest- environment relations; pest ecology and population dynamics.

Practices and Advances in Animal Production Systems

Course Description: Current practices and recent developments in animal production systems.

Animal Forage, Feeds and Nutrition

Course Description: The production and utilization of pasture and fodder crops including, techniques in grassland research and cost of production; Advances in animal nutrition research and in industry practices.

Animal Physiology and Environment

Course Description: Elucidation and evaluation of the response of animals to climate change and other environmental changes, their effects on animal adaptation, body temperature regulation, and related nutritional, metabolic and hormonal functions and implications to production and management.

Agroecosystem Analysis and Design of Sustainable Crop and Animal Production Systems

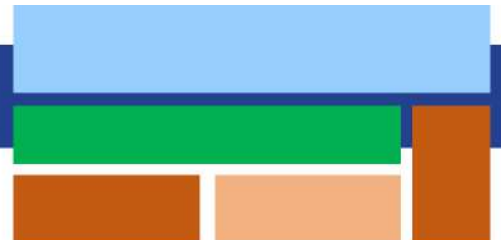
Course Description: Dynamics of agroecosystem components in relation to agriculture practices, issues and concerns; analysis, evaluation and design of sustainable farming systems.

Land, Soil and Water Resources Assessment and Management in Agriculture

Course Description: Analysis of environmental factors affecting land/water use; soil microbe plant interactions; land, soil and water resources management vis a vis competitive uses and ecological impacts.

Practices and Advances in Fisheries/Aquaculture Production Systems

Course Description: Current practices and recent developments in fisheries/aquaculture production.



Specialization Area: Forestry

Specialization Outcomes

After completing the MS FSCC- Forestry specialization/track, the student should be able to:

1. Understand the interrelationship of forests, food security, and climate change
2. Manage basic and applied research on current issues on forests, food security, and climate change
3. Promote collaborative, participatory, and community based approaches to sustainable forest management for food security and climate resiliency
4. Apply forestry practices to address issues on food security and climate change

Core Specialization Course:

Course Title: Forests and a Changing Climate

Course Description: Analysis of the relationship between forests and climate change, their impacts and corresponding strategies for adaptation and mitigation,

Prerequisite: None

Course Credit: 4 (3- 1) units

Number of hours: 3 class, 1 lab/field work/ practical

Course Goal: To enhance knowledge on forest growth and development, the relationship between forests and climate change, and analyze strategies for adaptation and mitigation

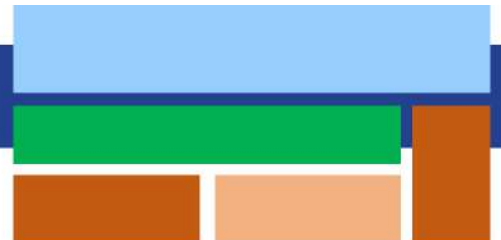
Course Outcomes

After completing the course, the student should be able to:

1. Discuss forest growth and development;
2. Analyze the relationship between climate change and forests and vice versa; and
3. Develop recommendations on sustainable forest management to enable communities to adapt to and mitigate climate change impacts.

Course Mapping

Course Outcomes	Professional Domains			Specialization Outcomes (Forestry Track)			
	PM	RE	DO	1	2	3	4
CO1 Discuss forest growth and development;		/	/	/	/		
CO2 Analyze the relationship between climate change and forests and vice versa; and	/	/	/	/	/	/	
CO3 Develop recommendations on sustainable forest management to enable communities to adapt to and mitigate climate change impacts.	/	/	/		/	/	



Course Content

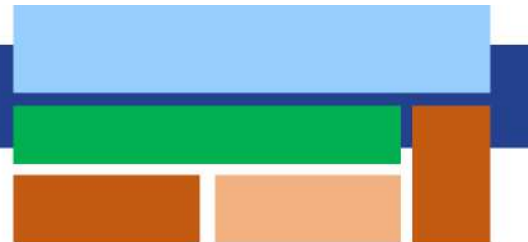
Lecture

Week	Course Outcomes	Topics	TLA	No. of Hrs.
1-2	CO1	I. Introduction to Forests A. Forest growth and development B. Factors affecting forest growth and development C. Silviculture and silvicultural systems	- Lecture - Discussion	6
3	CO2	II. The Changing Climate A. Climate change and global warming B. Global forest resources and land use change C. International agreements and protocol of climate change mitigation and adaptation	- Lecture - Discussion - Video presentation	3
4-5	CO2	III. Forests as carbon source and sink A. Biogeochemical cycles B. Roles and importance of forest biomass C. Components of forest biomass D. Biomass and carbon pools E. Types of GHGs from the forestry sector	- Lecture - Discussion	6
6 to 8	CO2	IV. Impacts of Climate Change on Forests A. Growth rates B. CO ₂ fertilization C. Biodiversity D. Wild fire E. Pest and diseases F. Forest communities	- Lecture - Discussion - Literature review and focus group discussion	9
9-10	CO2	V. Impacts of Forests on Climate Change A. Forest degradation and deforestation B. Land use and land use change	- Lecture - Discussion - Video - Literature review and focus group discussion	6
11	CO2	Mid-term Evaluation		3

12-13	CO3	VI. Sustainable Forests Management and Climate Change Mitigation A. Carbon sequestration Reducing Emissions from Deforestation and Forest Degradation	- Lecture - Discussion - Video - Class debate	6
14-15	CO3	VII. Sustainable Forests Management and Climate Change Adaptation A. Global initiatives B. Regional initiatives C. Local initiatives	- Lecture - Discussion - Video - Class debate	6
16	CO3	Final Evaluation		3

Laboratory/Field Work

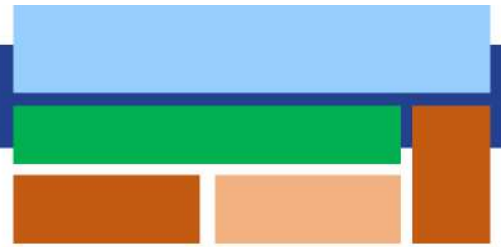
Week	Course Outcomes	Topics	TLA	No. of Hrs.	AT
1-2	CO1	Exercise 1: Forest growth and development	- Group or individual presentation	6	Report
3	CO2	Exercise 2: International agreements and protocol of climate change mitigation and adaptation	- Literature review - Case study - Discussion	3	Report
4-5	CO2	Exercise 3: Forest biomass assessment	- Field work - Group or individual presentation	6	Report
6 to 10	CO2	Exercise 4: Impact assessment	- Field work - Quantitative and qualitative analysis	15	Report
11 to 16	CO3	Exercise 5: Formulation of mitigation and adaptation strategies	- Field work - Quantitative and qualitative analysis	18	Report



Course Requirements: Examination, Report, Paper presentation

Assessment

Assessment Tasks	Weight (%)	Minimum Average for Satisfactory Performance (%)
Mid-term evaluation	30	75%
Final evaluation	30	75%
Lab report/ practical exam	40	75%



Specialization Elective Courses:

Water and Watershed Management

Course Description: Interception, transpiration, evaporation and sedimentation related to the quantity, quality and distribution of water as affected by forestry practices.

Landscape Structure and Biodiversity

Course Description: Landscape pattern and process; mechanisms by which it changes through time; its influence in shaping biodiversity, and implications to populations, communities, and ecosystems.

Agroforestry

Course Description: Micro-analysis and application of management principles on agroforestry farms.

Non-timber Forest Products

Course Description: Properties, processing and utilization of non-timber forest products.

Forest Ecosystem Health and Services

Course Description: Forest ecosystem health concepts, indicators, assessment methods, and impacts on human well-being.

Forest Biometry

Course Description: Analysis of forest measurements; evaluation of growth prediction methods recent developments in forest mensuration and statistics.

Geospatial Methods in Forest Resources Management

Course Description: Application of geographic information systems (GIS) technology in natural resources management; IS operations and spatial analysis.

Social Forestry

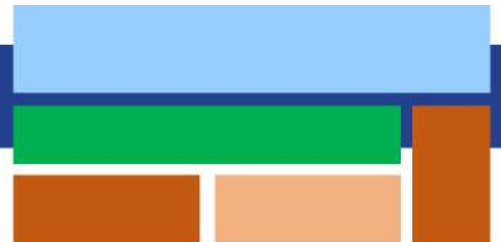
Course Description: Perspectives in social forestry and analysis of social forestry programme.

Forest Carbon Measurement and Monitoring

Course Description: The science, methods and practice of forest carbon measurement and monitoring for climate change mitigation and adaptation

Conflict Management in Planted Forest

Course Description: Analysis and management of conflicts in planted forests towards food security and climate change mitigation.



Specialization Area: Food Science

Specialization Outcomes:

1. Assess the contribution of food transformation in the food value chain (farm to fork) to food security and climate change
2. Identify problems and formulate solutions and/or recommendations to complex problems and research questions related to the importance of food quality and safety to food security and climate change
3. Assess the impact of the food production and processing to nutrition security and human health
4. Engage in life-long learning to keep pace with current developments in the field of food security and climate change as well as advance one’s own professional career

Core Specialization Course:

Course Title: Postharvest, Food Processing & Distribution in a Changing Climate

Course Description: This course covers food system from postharvest, processing and distribution. Various technologies in postharvest, processing and distribution and their impact on food security and climate change will be discussed.

Course Prerequisite: None

Course Credit: 3 units

Course Goal: At the end of the course, the students are expected to obtain a good understanding of technologies in food system and increase awareness their contribution to climate change.

Course Outcomes:

1. Distinguish various techniques in postharvest, food processing and distribution
2. Differentiate the techniques and their contribution to climate change
3. Formulate alternatives postharvest, food processing and distribution methods to alleviate contribution to climate change

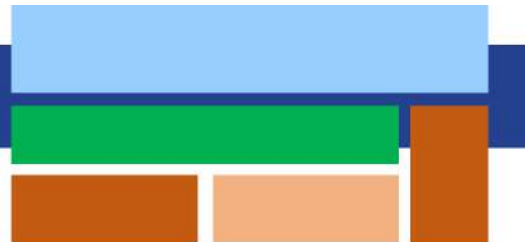
Course Mapping:

Course Outcomes	Professional Profile			Programme Outcomes						Specialization Outcomes			
	PM	DO	RE	1	2	3	4	5	6	1	2	3	4
CO1: Distinguish various techniques in postharvest, food processing and distribution	/	/	/		/				/	/	/		
CO2: Differentiate the techniques and their contribution to climate change		/	/		/	/			/	/	/		

CO3: Formulate alternatives postharvest, food processing and distribution methods to alleviate contribution to climate change		/	/		/	/		/	/	/	/	/	/
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Course Content:

Week	Course Outcomes	Topics	Teaching and Learning Activity	Assessment Tool	Number of Hours
1, 2	CO1, CO2, CO3	I. Overview of postharvest handling <ul style="list-style-type: none"> • The fresh produce agribusiness system and value chain management • Quality and safety attributes of fresh horticultural produce • Impact of technologies to climate change 	Lecture Site Visit	Quiz	6
3, 4, 5, 6	CO1, CO2, CO3	II. Food Processing <ul style="list-style-type: none"> • Thermal • Non-thermal • Impact of technologies to climate change 	Lecture Plant Tour	Quiz Exam Report	12
7, 8, 9	CO1, CO2, CO3	III. Current technology in food packaging <ul style="list-style-type: none"> • Types of packaging system • Modified atmosphere packaging system • Smart food packaging system • Active food packaging system • Impact of technologies to climate change 	Lecture Group Discussion	Quiz Oral Presentation	9
10, 11, 12	CO1, CO2,	IV. Food Distribution <ul style="list-style-type: none"> • Food Logistics 	Lecture Site Visit	Quiz	9



	CO3	<ul style="list-style-type: none"> • Time-Temperature Abuse in the Food Value Chain • Cold chain • Impact of technologies to climate change 		Reaction Paper	
13, 14	CO1, CO2, CO3	V. Waste Management <ul style="list-style-type: none"> • Waste management in the Food Industry • Impact of technologies to climate change 	Lecture Site Visit	Quiz	6

Assessment:

Assessment Task	Course Outcome	Weight in Final Grade	Minimum Average for Satisfactory Performance
Exam	CO1	15%	65-80% or B
Exam	CO2	15%	
Reports and Oral Presentation	CO3	40%	65-80% or B
Final Exam	CO1, CO2 & CO3	30%	65-80% or B

Specialization Elective Courses:

Food Nutrients/ Nutrition

Course Description: This course covers discussion on food components as well as non-nutrient components; physiological changes and metabolism

Food Safety Management

Course Description: This course covers the concept and principles in ACCP and risk analysis of microbiological, chemical and physical hazards in foods. The methods for education of hazards in foods are discussed.

Microbiological Food Safety

Course Description: The lectures discuss conventional as well as emerging foodborne pathogens with regard to their behavior and survival in foods, the diseases they may cause, pathogenicity, transmissions, and epidemiological studies pertaining their outbreaks. The lecture will also discuss the development of risk-based food safety management and the role of microbiological risk analysis in food safety management.

Food Toxicology

Course Description: Naturally occurring food toxins, sources, mechanisms, nature, toxigenicity, of bacterial and fungal toxins as well as methods of detection.

Post-harvest Physiology and Biochemistry of Fruit and Vegetables

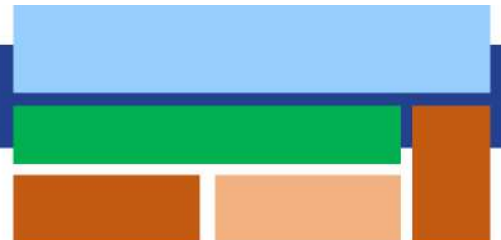
Course Description: Biochemical and physiological changes in plant based products and their quality after harvest.

Advanced Food Packaging

Course Description: This course covers food packaging which encompasses concept and functions of packaging, food protection, packaging materials and manufacturing, packaging materials testing methods, type of failures in food packaging, forms of packaging system, packaging and application, packaging equipment, and current and future developments in food packaging.

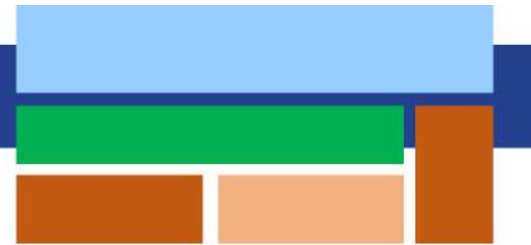
Food Regulation

Course Description: Food laws and regulations; ethical standards; international and food laws and regulations.

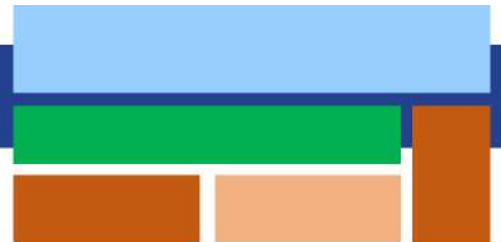


Course Content

Week	Course Outcomes	Topics	Teaching and Learning Activity	Assessment Tool	Number of Hours
1,2	CO 1	A. Concepts, Principle, Perspectives and Approaches in Risk Assessment and Management <ul style="list-style-type: none"> • Risk and risk analysis • Vulnerability • CCA & CCM • Resilience • DRM • Risk Management Frameworks and Approaches 	<ul style="list-style-type: none"> • Lecture-discussion • SCL + PBL 	<ul style="list-style-type: none"> • Assignments • Class participation/recitation • Exam 1 	6
3,4,5,6	CO 2	B. Hazards, Exposures and Susceptibility <ul style="list-style-type: none"> • Hydro-meteorological • Geological • Biological C. Vulnerability and Sensitivity Assessment <ul style="list-style-type: none"> • Landscape Approach • Sectoral VA • Index-based D. Assessing adaptive capacities	<ul style="list-style-type: none"> • Lecture-discussion • Group workshops/discussions • SCL + PBL 	<ul style="list-style-type: none"> • Class participation/recitation • Assignments • Exercises • Exam 1 	6 6
7, 8	CO 2	E. Computing for and evaluating risks <ul style="list-style-type: none"> • Tolerable risk • Acceptable risk • Worse case risks 			6
9	CO 2	G. Multi-hazard risk assessment	<ul style="list-style-type: none"> • Lecture-discussion 	<ul style="list-style-type: none"> • Class participation/recitation • Assignments 	3



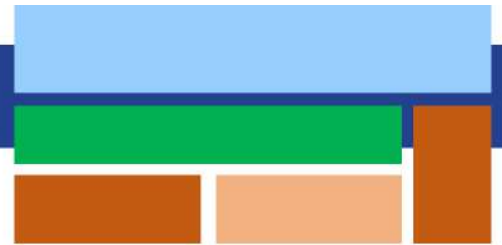
		<ul style="list-style-type: none"> • Calculating multi-hazard risks • Probabilistic • Deterministic 	<ul style="list-style-type: none"> • Group workshops/discussions • Group reporting • SCL + PBL 	<ul style="list-style-type: none"> • Exercises • Reports • Exam 2 	
10,11	CO 2, CO 3	<p>H. Climate Change Adaptation and Mitigation</p> <ul style="list-style-type: none"> • Stakeholders engagement/ Participatory Approach • Capacity development of stakeholders • Prioritization • Multi-criteria analysis; Spatial MCA • Economic considerations (Sensitivity analysis; BCA; CEA) 	<ul style="list-style-type: none"> • Lecture-discussion • Group workshops/discussions • Group reporting • SCL + PBL 	<ul style="list-style-type: none"> • Class participation/recitation • Assignments • Exercises • Reports • Exam 2 	6
12,13	CO 3	<p>I. Communicating Climate and Disaster Risks</p> <ul style="list-style-type: none"> • Risk communication • Crisis communication • Public disclosure • Enculturation <p>J. Planning for Risk Interventions, CCA and CCM</p> <ul style="list-style-type: none"> • Conflict resolution and consensus development • Networking and alliance building <p>K. Issues in Assessment, Management and</p>	<ul style="list-style-type: none"> • Lecture-discussion • Group workshops/discussions • Group reporting • SCL + PBL 	<ul style="list-style-type: none"> • Class participation/recitation • Assignments • Exercises • Reports • Exam 2 	6



		Governance for Climate Risks Management			
14	CO 1-3	L. Synthesis <ul style="list-style-type: none"> • Climate Change and its Impact on Food Security, Human Health and Well-being 	Group reports and sharing SCL + PBL	Assignments Reports	3

Assessment:

Assessment Task	Course outcomes	Weight in final grade	Minimum average for satisfactory performance
Midterm exam	1,2,3,4	30	To follow grading scheme of host university
Final exam	1,2,3,4	30	
Case analysis	3,4	20	
Assignments	1,2,3,4	10	
Class participation	1,2,3,4	10	



Specialization Elective Courses:

Decision Support System for Food Security in a Changing Climate

Course Description: Knowledge databases, utility of geo-portals and climate models, and tools for improved decision-making for climate change interventions

Climate Change, Vulnerability and Adaptation

Course Description: Covers concepts and techniques of impact and vulnerability assessment to climate change by utilizing dynamic and empirical models in a region and/or sector of the economy by using statistical evaluation techniques. Results of the assessment is used for the preparation of climate change adaptation plans and action.

Life Cycle and System Analysis

Course Description: Tools, methods and approaches in assessing and managing climate risks, particularly those that impact food security; issues and challenges in climate risk management.

Geoinformatics

Course Description: Covers overview of IS, its applications, algorithms and general methodology, functionality of its components and the interrelationships between IS and other sciences and technologies, includes practical assignments concerned database building, data analysis, modelling, cartographic production and data transfer.

Dynamics of Climate Change and Environment

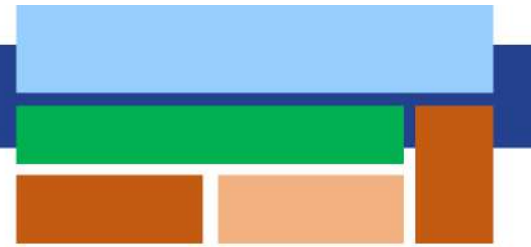
Course Description: Effect of climate change on coastal environment, adaptation and mitigations strategies, international cooperation that mitigate climate change impacts and case studies

Environmental Communication

Course Description: Application of environmental communication principles, strategies, and techniques to address risks, controversies, and crises associated with the environment.

Governance Framework for DRR and CCA

Course Description: Covers different theories, development and governance concepts, values and interventions relevant to development contexts; devise innovative, participatory and multi-disciplinary approaches to respond to development and governance issues and concerns affecting organizations, communities and societies; design and implement research and technical assistance programmes on development management and governance.



Specialization Area: Public Policy and Economics

Specialization Outcomes

After completing the MS FSCC Public Policy and Economics specialization/track, the student should be able to have:

1. Sufficient appreciation and understanding of economic theories for analyzing food security and climate change issues and problems;
2. The ability to conduct economic valuation of natural and environmental goods , services and resources;
3. The capacity to conduct policy analysis for addressing food security problems and climate change impacts in relation to natural resource and environmental management; and
4. Enhanced research capacity and ability to provide evidence-based solutions to food security and climate change problems.

Core Specialization Course:

Course Title: Economics and Policy Issues in Food Security and Climate Change

Course Description: Economic theories and the policy issues on the interrelationships of food security and climate change

Prerequisite: Consent of instructor

Course Credit: 3 units

Course Goal: For the students to have sufficient appreciation and understanding of how economic theories are used in the analysis of policy issues relating to food security and climate change

Course Outcomes:

After completing the course, the student should be able to:

1. Identify the policy issues and concerns in food security and climate change;
2. Discuss the economic theories and concepts related to food security and climate change; and
3. Distinguish among the different policies and programmes for addressing food security and climate change problems and policy issues.

Course Mapping:

Course Outcomes	Professional Domains			Specialization Outcomes			
	PM	DO	RE	1	2	3	4
CO1: Identify the policy issues and concerns in food security and climate change	/		/	/			
CO2: Discuss the economic theories and concepts related to food security and climate change	/	/	/	/	/	/	/

CO3: Distinguish among the different policies and programmes for addressing food security and climate change problems and policy issues	/	/	/			/	/
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Course Content:

Week	Course Outcomes	Topics	Teaching and Learning Activity	Assessment Tool	Number of Hours
1	CO1	I. Economic Perspective and Policy Issues on Food Security and Climate Change a. Economic growth and sustainable development b. Food security, climate change, and poverty linkage c. Economic impacts of climate change on agriculture and food security	Lecture, discussion, presentation, group video	Diagnostic test	3 hours
2-4	CO2	II. Economic Concepts Related to Food Security and Climate Change a. Supply, demand, price, and market b. Costs, benefits, and values c. National income accounting d. Green economy	Lecture, discussion, group	Quizzes, Exercises	9 hours
5-6	CO2	III. Market Efficiency and Market Failure related to Food Security and Climate Change a. Economic efficiency and market system b. Market failure, externalities, and public goods	Lecture, Economic game, Group discussion, Debate	Homework Quizzes	6 hours

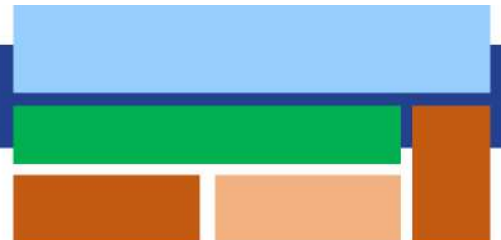
		<ul style="list-style-type: none"> c. Property rights, and equity d. Public policy and intervention 			
7-8	CO1, CO2	<p>IV. Protecting Food Security through Adaptation to Climate Change</p> <ul style="list-style-type: none"> a. Living with uncertainty and managing new risks b. Strengthening resilience and managing change c. Other policies 	Article review and presentation, Lecture-discussion	Presentation mark, midterm exam (topics 1-4)	6 hours
9-10	CO3	<p>V. Protecting Food Security through Mitigation of Climate Change</p> <ul style="list-style-type: none"> a. Reducing emissions b. Sequestering carbon c. Ecosystem/sector specific policies 	Policy paper review, Lecture, Group discussion	Paper review submission	6 hours
11-13	CO3	<p>VI. National Programmes for Food Security and Climate Change</p> <ul style="list-style-type: none"> a. Production support and R&D b. Food price stabilization, buffer stocks and food subsidies c. Marketing assistance and producer-buyer linkages d. Infrastructure and communication support e. Disaster preparedness, prevention and coping 	Lecture-discussion, Guest lectures from stakeholders (private and public), Attendance in seminar or forum	Reaction paper submission Quiz	9 hours

		f. Indigenous people safeguards			
14-15	CO3	VII. Economic and Policy Support for Integrating Climate Change in Food Security a. Capacity-building for policy analysis b. Monitoring and evaluation of CC-FS programmes c. Enabling policies and institutions d. D. Strengthening regional and international economic cooperation	Lecture discussion, Guest lectures from stakeholders, Group discussion	Paper submission Evaluation test	6 hours
Exams (Midterm and Final)					3 hours

Course Requirements: Quizzes, Exams, Homework, Paper submission, Oral presentation, Diagnostic and evaluation tests

Assessment:

Assessment Task	Course Outcome	Weight in Final Grade	Minimum Average for Satisfactory Performance
Diagnostic and evaluation tests	CO1, CO2, CO3	10%	65-80% or B
Quizzes	CO2	10%	65-80% or B
Exams	CO1, CO2, CO3	40%	65-80% or B
Homework	CO2	10%	65-80% or B
Paper submission	CO3	20%	65-80% or B
Oral presentation	CO1, CO2	10%	65-80% or B



Course Title: Economic Valuation for Food Security and Climate Change

Course Description: Characteristics and services of natural resources and environment; economic concepts and valuation techniques applied to food security and climate change issues.

Prerequisite: Consent of instructor

Course Credit: 3 units

Course Goal: For the students to acquire knowledge on welfare economics and analytical tools for estimating the economic values of natural resources and the environment in relation to food security and climate change

Course Outcomes:

After completing the course, the student should be able to:

1. Discuss the needs of economic valuation for non-market goods and services related to food Security and climate change issues;
2. Identify types of economic values and appropriate valuation techniques; and
3. use the valuation techniques to estimate benefits and costs associated with welfare changes

Course Mapping

Course Outcomes	Professional Domains			Specialization Outcomes			
	PM	DO	RE	1	2	3	4
CO1: discuss the needs of economic valuation for non-market goods and services related to food security and climate change issues	/		/	/	/	/	/
CO2: identify types of economic values and appropriate valuation techniques	/		/	/	/	/	/
CO3: use the valuation techniques to estimate benefits and costs associated with welfare changes	/		/	/	/	/	/

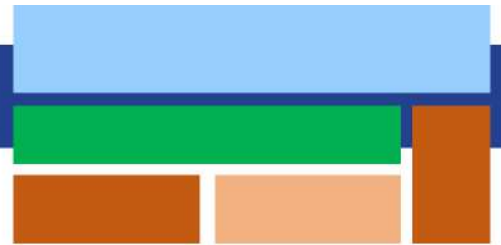
Course Content:

Week	Course Outcomes	Topics	Teaching and Learning Activity	Assessment Tool	Number of Hours
1	CO1	I. Introduction and Overview a. Roles and importance of	Watching video, Lecture-discussion	Diagnostic test	6 hours

		<p>economic valuation</p> <p>b. Functions and services of nature</p> <p>c. Definition of value and benefit</p>			
2-3	CO2	<p>II. Economic Valuation for Policy Application</p> <p>a. Classification of economic value</p> <p>b. Marginal, non-marginal, and total value</p> <p>c. Policy applications and decision tools</p>	<p>Brain storming, Lecture Group discussion</p>	<p>Quiz</p>	<p>6 hours</p>
4-5	CO2, CO3	<p>III. Economic Theory of Value and Measurement</p> <p>a. Consumer welfare measurement</p> <p>b. Producer welfare measurement</p> <p>c. The environment and social welfare</p> <p>d. D. Valuation approaches</p>	<p>Lecture, Individual exercises</p>	<p>Homework Exercises</p>	<p>6 hours</p>
6-7	CO2, CO3	<p>IV. Direct Benefit Valuation: Contingent Valuation Method (CVM)</p> <p>a. Conceptual foundation and model</p> <p>b. Valuation techniques and steps of analysis</p> <p>c. C. Case studies</p>	<p>Lecture, Individual presentation of valuation study, Group computer-based exercises</p>	<p>Presentation, Group exercises, Mid-term exam for topics 1-4)</p>	<p>6 hours</p>
8-9	CO2, CO3	<p>V. Direct Benefit Valuation: Choice Experiment (CE)</p> <p>a. Conceptual foundation and model</p> <p>b. Valuation techniques and steps of analysis</p> <p>c. Case studies</p>	<p>Lecture, Individual presentation of valuation study, Group computer-based exercises</p>	<p>Presentation and discussion Exercises</p>	<p>6 hours</p>

10-11	CO2, CO3	VI. Indirect Benefit Valuation: Travel Cost Method (TCM) a. Conceptual foundation and model b. Valuation techniques and steps of analysis c. Case studies	Lecture, Individual presentation of valuation study, Group computer-based exercises	Presentation and discussion Exercises	6 hours
12-13	CO2, CO3	VII. Indirect Benefit Valuation: Hedonic Pricing Method (HPM) a. Conceptual foundation and model b. Valuation techniques and steps of analysis c. Case studies	Lecture, Individual presentation of valuation study, Group computer-based exercises	Presentation and discussion Exercises	6 hours
14-15	CO2, CO3	VIII. Secondary Valuation Approach: Benefit transfer (BT) a. Conceptual foundation and model b. Valuation techniques and steps of analysis: Value transfer c. Valuation techniques and steps of analysis: Function transfer d. Case studies	Lecture, Individual presentation of valuation study, Group computer-based exercises	Presentation and discussion Exercises	6 hours
16	CO2, CO3	IX. Other Valuation Approaches a. Conventional market valuation b. Life cycle assessment	Lecture, Individual presentation of valuation study, Group computer-based exercises	Presentation and discussion Exercises Evaluation test	6 hours
Exams (Midterm and Final)					3 hours

Course Requirements: Quizzes, Exams, Homework, Paper submission, Oral presentation, Diagnostic and evaluation tests



Assessment:

Assessment Task	Course Outcome	Weight in Final Grade	Minimum Average for Satisfactory Performance
Diagnostic and evaluation tests	CO1, CO2, CO3	10%	65-80% or B
Quizzes	CO1	5%	65-80% or B
Exams	CO1, CO2, CO3	40%	65-80% or B
Homework	CO2	5%	65-80% or B
Exercises	CO2, CO3	25%	65-80% or B
Oral presentation	CO1, CO2, CO3	15%	65-80% or B

Specialization Elective Course:

International Trade

Course Description: Deals with the causes of trade and effects on food security and climate change.